AUTOMOTIVE INDUSTRIES

A CHILTON PUBLICATION

AUGUST 15, 1959

Features • • •

WHAT THE ARMY NEEDS IN ENGINES

STANDARDIZATION OF MACHINE TOOLS

MAGNESIUM FOR AUTOMOTIVE PARTS

MAJOR GAINS SEEN IN MARINE ENGINES

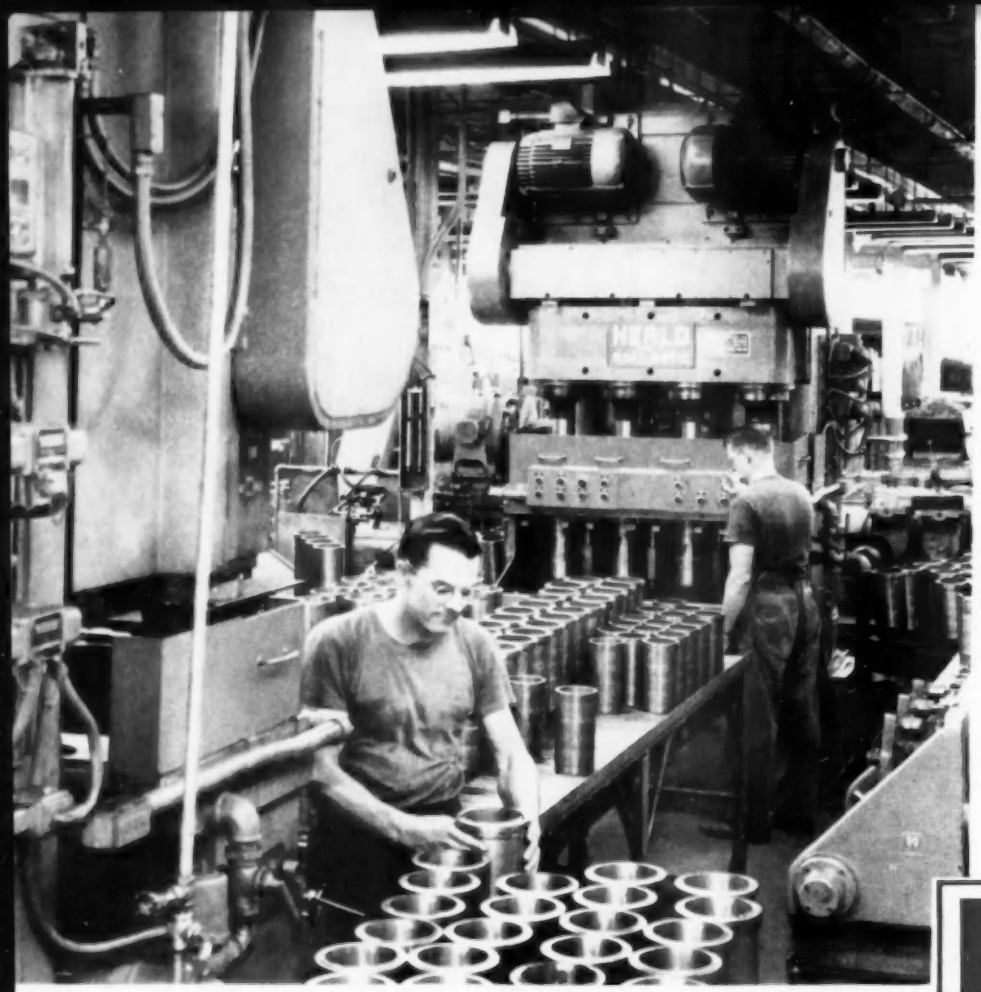
test driving ▶

Watching One Man Test "Drive" Eight Cars at One Time

PAGE 53

Automotive and Aviation Manufacturing

ENGINEERING • PRODUCTION • MANAGEMENT



Two Heald Model S Bore-Matics installed in diesel engine plant for rough and finish boring cast iron cylinder liners. Unit in foreground performs the roughing operation, with capacity of up to ¼" of stock removal on four parts at a time, followed by finish boring on identical machine at the right.

HEALD

KING-SIZE BORE-MATICS

rough and finish bore diesel cylinder liners FOUR AT A TIME

HEAVY-DUTY roughing and precision finish boring are the dual functions of the two Heald Model S Bore-Matics shown above. Installed in a large diesel engine plant, these huge, 40,000-pound machines are identical except for tooling — each handling four large cast iron cylinder liners at a time.

One machine, used for the roughing operation, is capable of removing a full quarter inch of stock — the other is used for finish boring to close tolerances for size and concentricity. Each four-station machine is equipped with a hydraulic clamping fixture and operates on a fully automatic push-button-controlled cycle. Total cycle time is 266 seconds on the roughing operation, with a net production of approximately 40 parts per hour.

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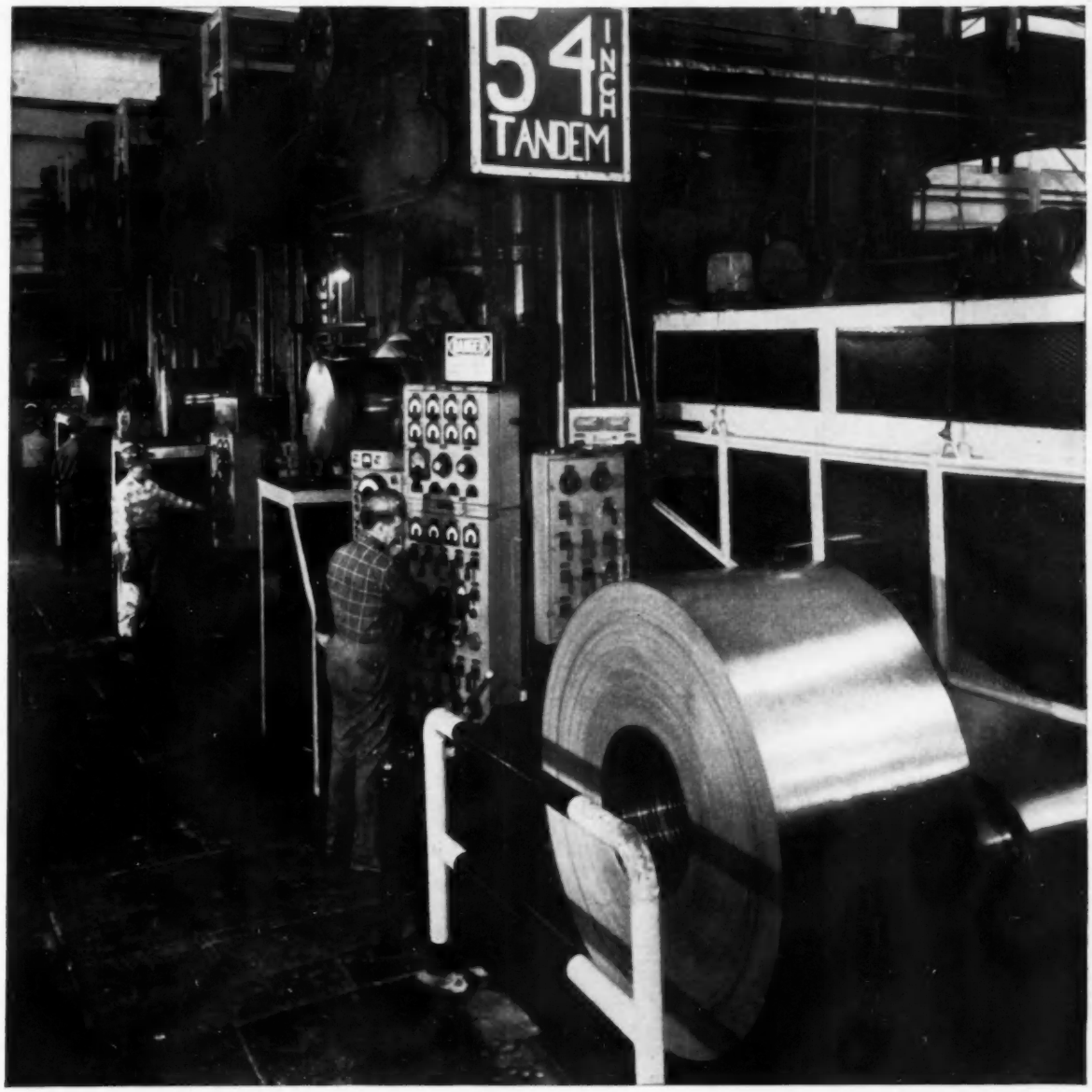

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AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE · PUBLISHED SEMI-MONTHLY

AUGUST 15, 1959 VOL. 121 No. 4

Features • • •

▼ **What the Army Needs in Engines**

Edward F. Blackburne, of the research and engineering directorate of the Ordnance Tank Automotive Command, Detroit, tells five practical ways that industry can use to help Ordnance achieve three major goals in design and operation of military engines. Page 55.

▼ **Standardized Machine Tools**

Agreement has been reached on a limited series of standard specifications for high-production machine tools. It is expected that adherence to these standards will permit replacement of one or more sections of a production line with other standard sections of later design. This could reduce changeover costs when new products are to be manufactured. Page 58.

▼ **Magnesium in Automotive Parts**

Service experience has shown that magnesium can be used for many functional automotive parts without protective finishes. Several graphic illustrations of actual case histories prove this point. Page 60.

▼ **Engines for New Line of GMC Trucks**

New V-6 and V-12 gasoline engines are now being developed for a line of trucks to be brought out by General Motors Corp., Truck and Coach Div. So far as can be determined, engines of such configuration constitute a first in the USA for use in trucks. All of them will have moderate compression ratio and will use regular gasoline. Page 62.

▼ **Advances in Marine Engines**

Features of new marine engines are expected to be influenced by greatly increased overall demand for higher power, more compact design, speed, mobility, and economy. Five typical makers report an average increase of 30 per cent in production. Page 66.

▼ **Balancing a V-6 Engine**

The new V-6 GMC truck engine does not have any special mechanism to supplement the balance of its counterweighted crankshaft and associated parts. The amplitude of engine vibration was calculated, and was found to be negligible. Operating tests confirmed this finding. Page 69.

▼ **Special Transfer Machines**

Special features of the transfer machines for cylinder blocks and heads at International Harvester Co. permit units of different dimensions to be machined in the same equipment. The setup for cylinder blocks is described in Part I of a two-part article by Joseph Geschelin, Detroit Editor. Page 70.

▼ **Versatile Automatic Lathe**

A special Gisholt automatic lathe, equipped with suitable tooling, is producing 10 different flywheels at the Detroit Diesel Engine Division of General Motors Corp. Simple changes in adjustments could provide for machining as many as 30 different flywheels. Page 73.

▼ **34 New Product Items, And Other Features, Such As:**

Industry Statistics, News of Machinery Industries, Airbriefs, and Farm Equipment Industry Report. . . . *continued on next page*

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NBP National Business Publications, Inc.

SBME Society of Business Magazine Editors

ABC Audit Bureau of Circulations

AUTOMOTIVE INDUSTRIES is a consolidation of The Automobile (weekly) and the Motor Review (weekly) May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

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AUTOMOTIVE INDUSTRIES

News Previews

"Medium Small" Cars 37
Dacron Tire Cords 38
1960 Production Begins 38
Electric Car Moves 38
Chrysler Valiant 39
Steel Shipments 39
U. S. Imports Top Exports 39
Norton Process May Cut Cost of Titanium 40
Chrysler Opens Plant 40
John Fritz Award 40
Defense Sales Drop 45
Bendix Gets Contracts 45
Air Conditioning 45
Car Without Wheels 46
Sunbeam Alpine Revives 47
New White Models 47
GM Sales Soar 47
Jobs at Dodge 47
Nuclear Seaplane 48
Inertial Guidance 48
Ride on Flying Saucer 48
High Altitude Vehicle 49
Nose Cone Locks Self in Stable Flight Position 49
Rocket Test Stand 49

Departments

Calendar of Coming Events 8
Letters to the Editor 13
News of the Automotive and Aviation Industries 37
Tabloid 46
Men in the News 51
Editorial Page 53
Industry Statistics 74
Farm Equipment Industry Report 75
New Plant and Production Equipment 76
New Automotive and Aviation Products 82
Airbriefs. *By David A. Partridge* 86
News of the Machinery Industry. *By Charles A. Weinert* 88
Shorties 102
On Our Washington Wire 104
Advertisers' Index 134
Free Literature ..... At Back of this Issue

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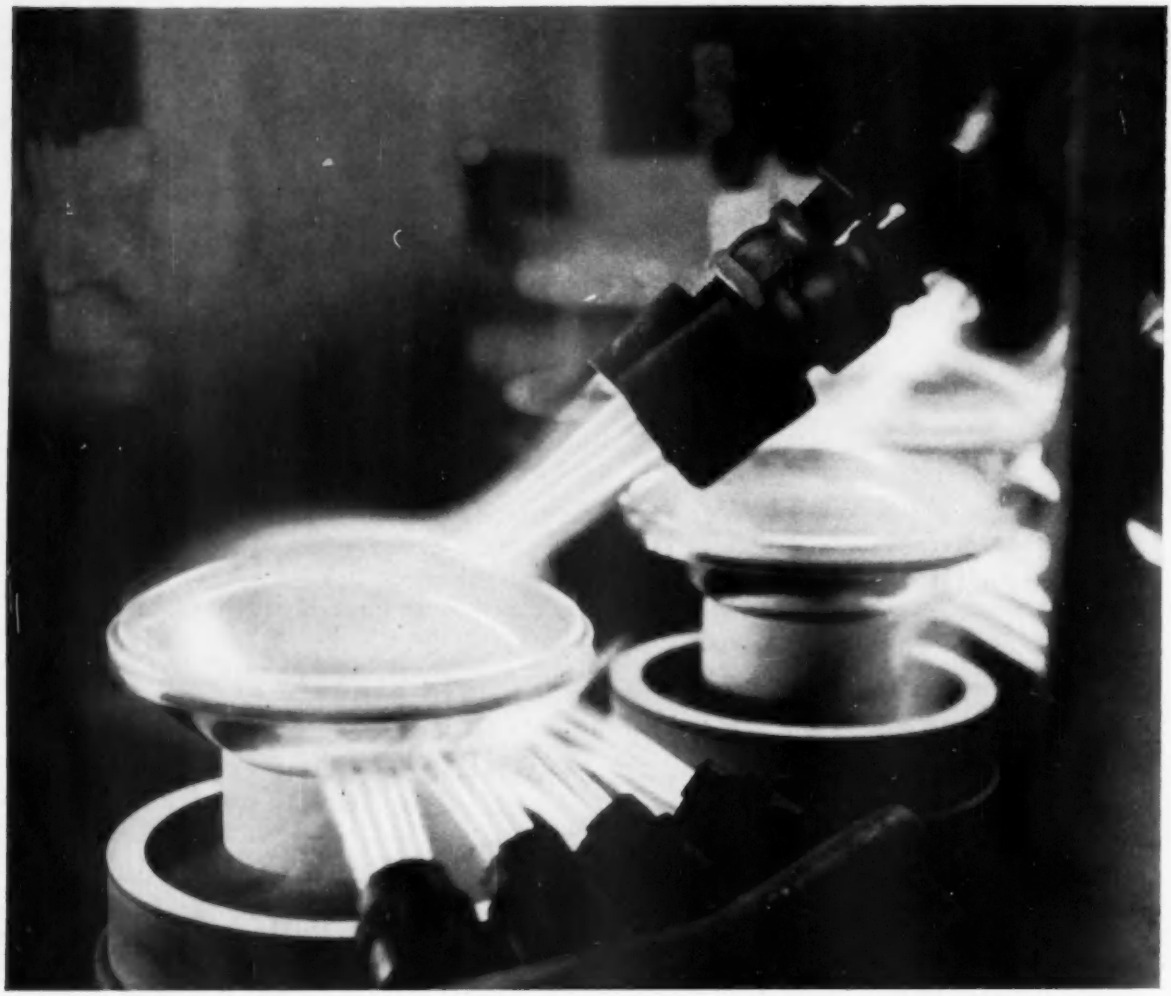

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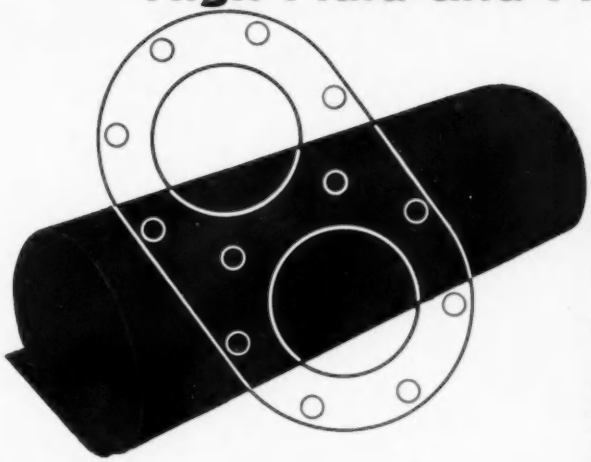

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1B	G-1111-1 (Federal Spec. HH-P-46A *P1161A	12±5	40	1800 psi.	20%
2 Graphite coated, one side	G-1111-1 *P1161A	12±5	40	1800 psi.	20%
3 Graphite coated, two sides	G-1111-1 *P1161A	12±5	40	1800 psi.	20%
50V	G-1122-1 (AMS 3232F) (Navy Spec. 33-P-13c) *P1141A	12±5	40	2000 psi.	10%
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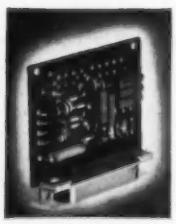

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Leipzig Fair, Germany....Aug. 30-Sept. 6

10th International Congress of Applied Mechanics, Congress Building, Stresa, Italy Aug. 31-Sept. 7

14th National ACM Conference Massachusetts Institute of Technology, Computation Center, Cambridge, Mass.....Sept. 1-3

Society of British Aircraft Construction, 20th flying display and exhibition, Royal Aircraft Establishment, Farnborough, England .....Sept. 7-13

Society of the Plastics Industry, Inc., Midwest Section Conference, French Lick Sheraton Hotel, French Lick, Ind....Sept. 10-12

Pressed Metal Institute, annual meeting, Estes Park, Col....Sept.13-17

SAE National Farm, Industrial Construction and Machinery Meeting, Milwaukee, Wis. Sept. 14-17

American Die Casting Institute, annual meeting, Edgewater Beach Hotel, Chicago, Ill.....Sept. 16-17

National Petroleum Association, annual meeting, The Traymore, Atlantic City, N. J.....Sept. 16-18

National Industrial Conference Board, 7th marketing conference, Hotel Waldorf-Astoria, New York, N. Y.....Sept. 16-18

International Automobile Show, Frankfurt, Germany .....Sept. 17-27

Steel Founders' Society of America, 57th fall meeting, The Homestead, Hot Springs, Va... .Sept. 21-22

Instrument Society of America, 14th annual instrument-automation conference and exhibit, International Amphitheater, Chicago, Ill. .....Sept. 21-24

Industrial Nuclear Technology Conference, Morrison Hotel, Chicago, Ill. .....Sept. 22-24

American Welding Society, national fall meeting, Sheraton-Cadillac Hotel, Detroit, Mich....Sept. 28-Oct. 1

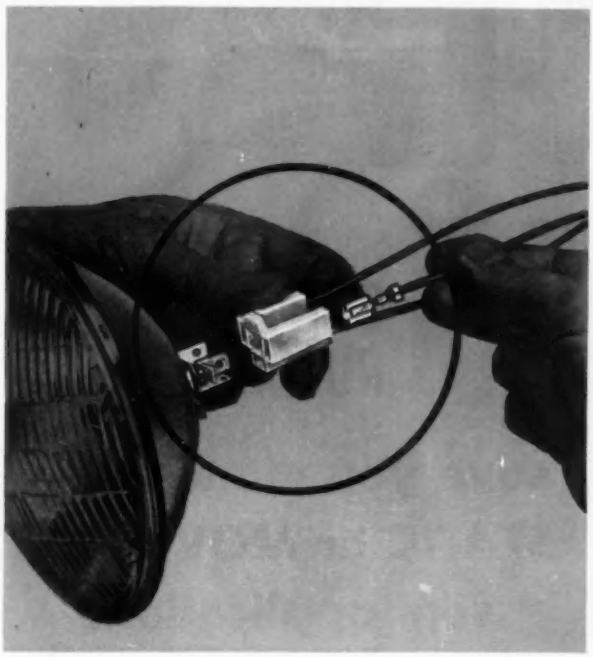
Paris Automobile Show.....Oct. 1-11

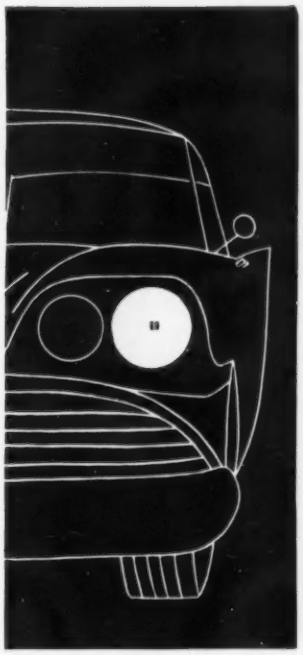
Institute of the Aeronautical Sciences, Anglo-American Conference, Hotel Astor, New York, N. Y. .....Oct. 5-16

American Vacuum Society, sixth national symposium on vacuum technology, Sheraton Hotel, Philadelphia, Pa. .....Oct. 7-9

ASTE semi-annual meeting, Chase-Park Plaza Hotels, St. Louis, Mo. .....Oct. 8-10

IT'S A SNAP . . .





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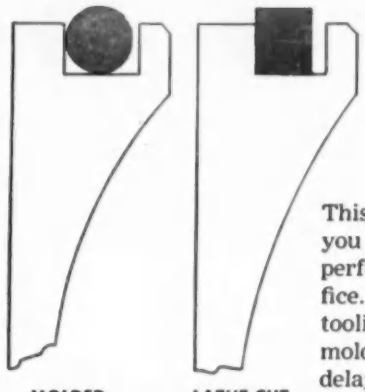

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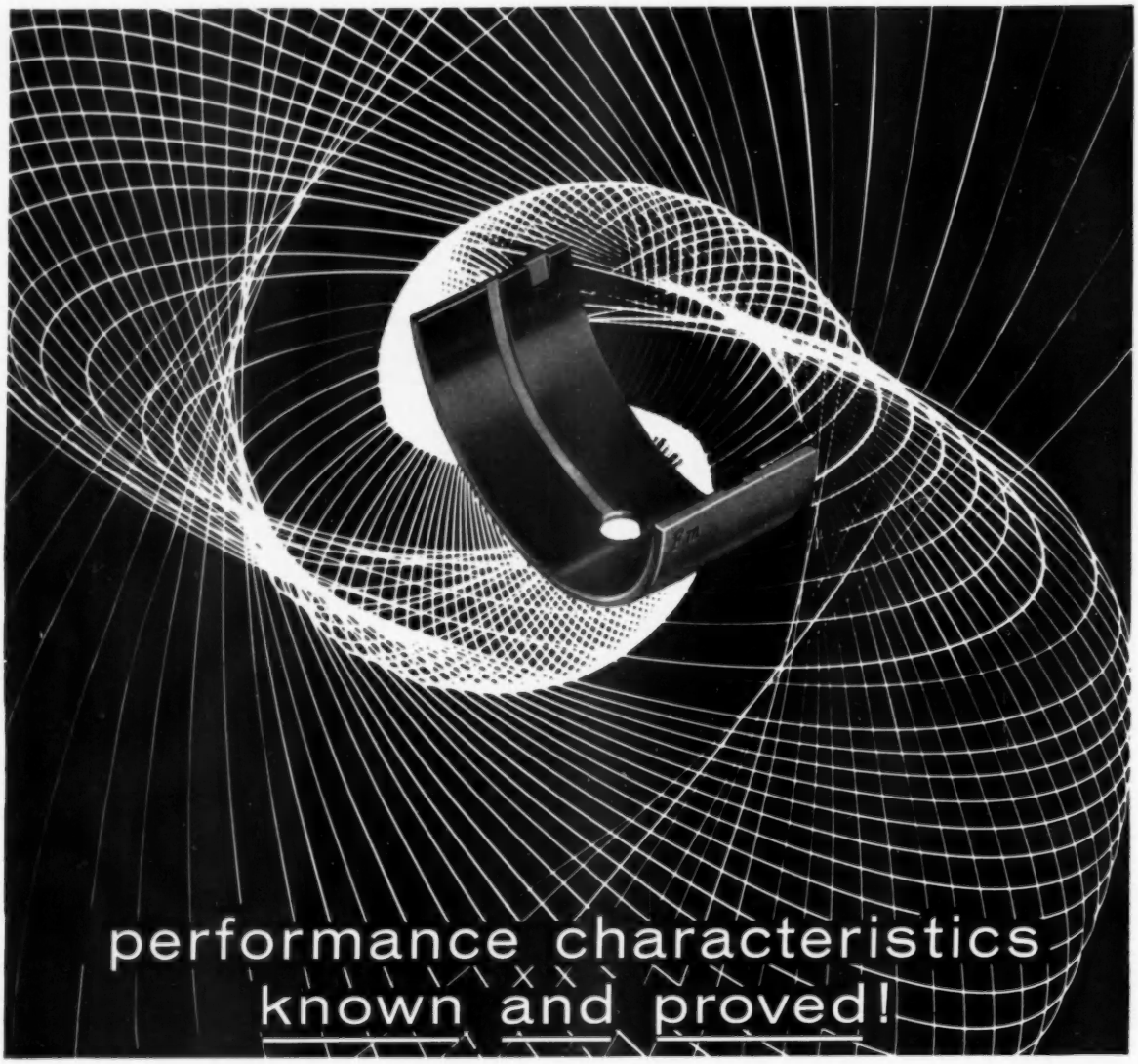

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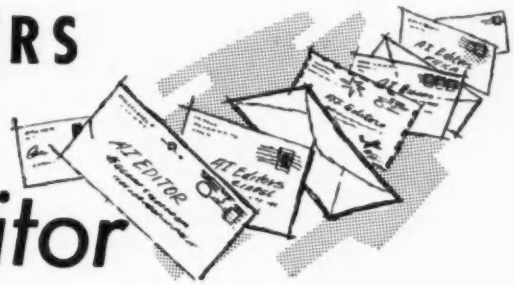


Readers' opinions or requests for additional information on material appearing in the editorial pages of AUTOMOTIVE INDUSTRIES are invited for this column. No unsigned letters will be considered, but names will be withheld on request. Address *Letters to the Editor*, AUTOMOTIVE INDUSTRIES, 56th & Chestnut Sts., Philadelphia 39, Pa.

MILITARY VEHICLES

We were surprised but very pleased to see a picture on the cover of the July 1 issue of AUTOMOTIVE INDUSTRIES of the American Motors M422 Mighty Mite ¼-ton, four-wheel drive vehicle being lifted by helicopter.

You might be interested in knowing that the M422 Mighty Mite was developed for the Marine Corps, specifically for tactical use with helicopter, and designed to a maximum weight of 1700 lb. This is a good example of the compact car principle applied to a military requirement. This vehicle has a newly developed American Motors V-4 air-cooled aluminum engine which develops 55 hp at 3600 rpm.

J. W. Eskridge
Vice President and
General Manager
Special Products Division
American Motors Corp.
12155 East Vernor Highway
Detroit 15, Mich.

I am appreciative of your continuing interest in articles on Military vehicular subjects. You can rest assured that we will be alert to any further opportunities where our activities may be of interest to your readers.

Nelson M. Lynde, Jr.
Major General, USA
Chief, Field Service Division

MACHINE TOOL SALES

I was very much interested in reading comments of various individuals in the machine tool industry, including my own, in the article "Machine Tool Sales Uptrend Evaluated in Telegraphic Survey" appearing in the July 1 issue of AUTOMOTIVE INDUSTRIES. I will say to you at this time that, since I wrote you, our backlog has increased very substantially. Odd as it may seem, the orders we are receiving do not come from the automotive industry as yet. We have very interesting quotations outstanding which we hope will develop into orders, but nothing of any sizable amount has as yet been received from that industry. We are well past the delivery point of January 1, 1960, and it is very pleasant after a long dry spell to have some relief by a good backlog on our order books.

C. R. Rosborough, President
Moline Tool Co.
Moline, Ill.

AI FEATURES

The editorial content and the general layout of your publication have greatly improved. In addition, the new departments or features that were added, i.e., the Editorial Page, Letters to the Editor, etc., are being well received by your readers.

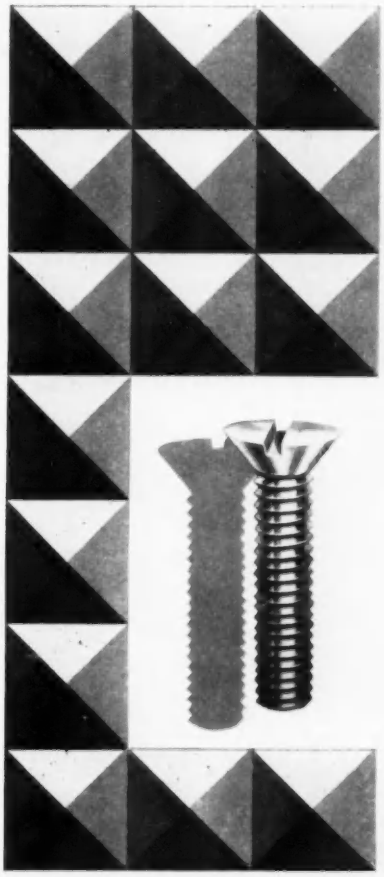
May I at this time congratulate you on the outstanding job you are performing. Please continue to keep up the good work. We in the automotive industry appreciate your every effort.

Alexander G. Kapocius
Harvey Works
Allis-Chalmers Mfg. Co.
Chicago 28, Ill.

INDIAN INDUSTRY

I am interested in seeking further technical collaborations for manufacture in India of automotive

(*Turn to page* 100, *please*)



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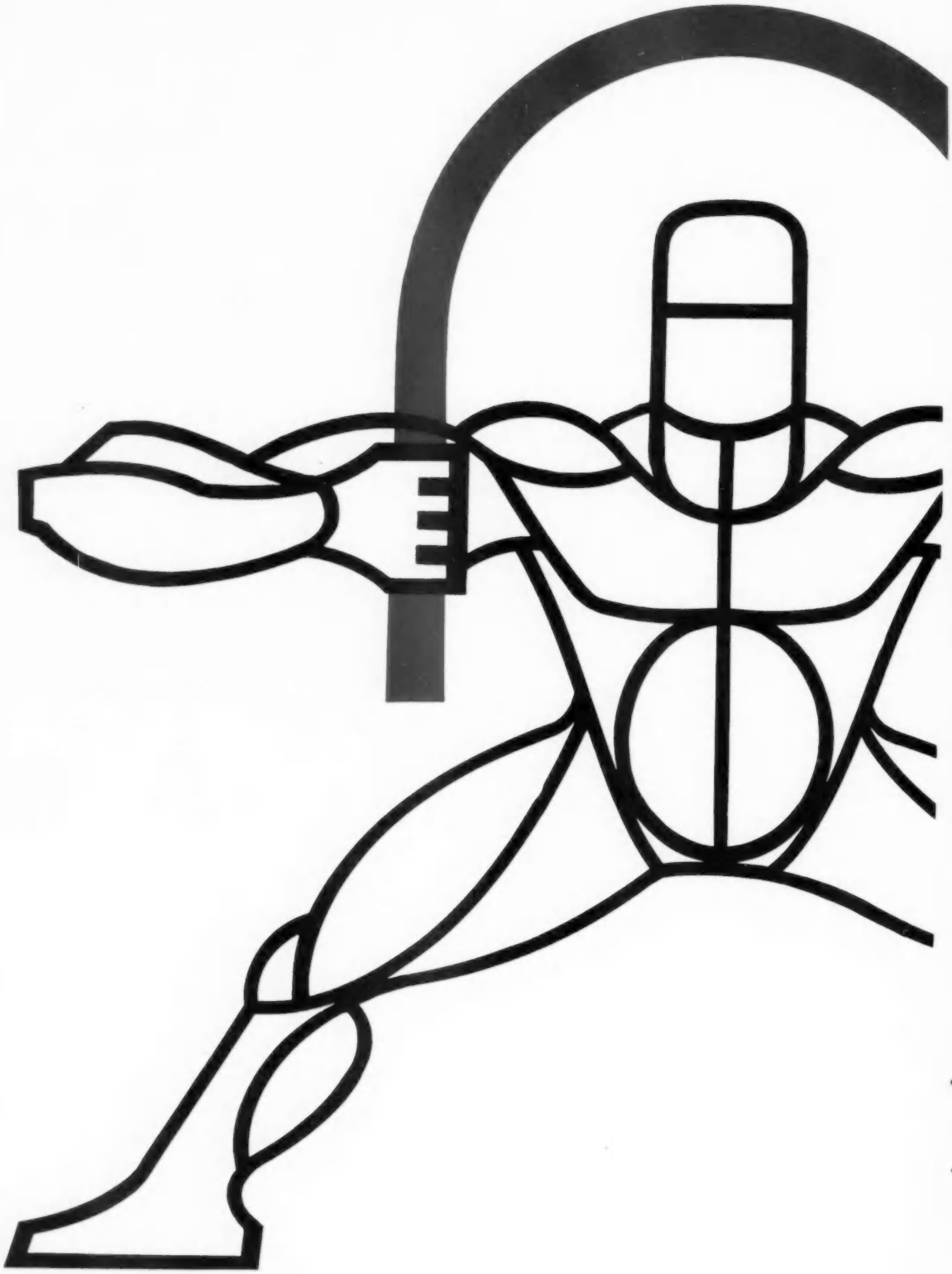

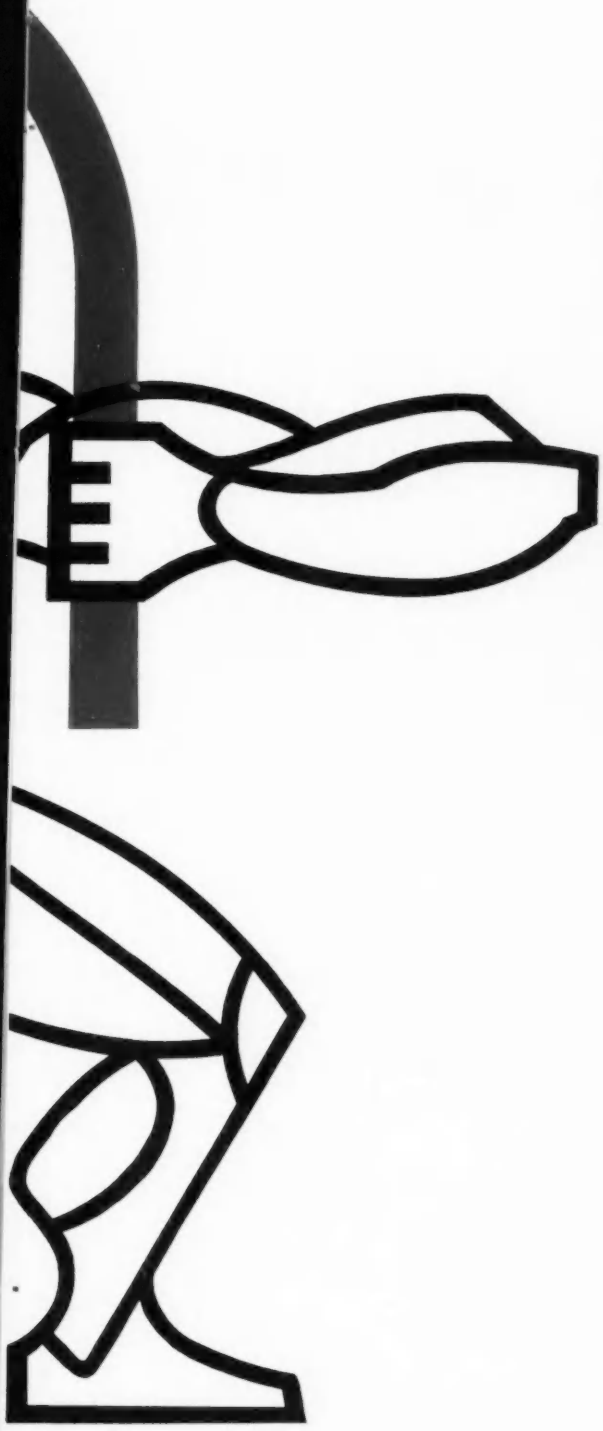

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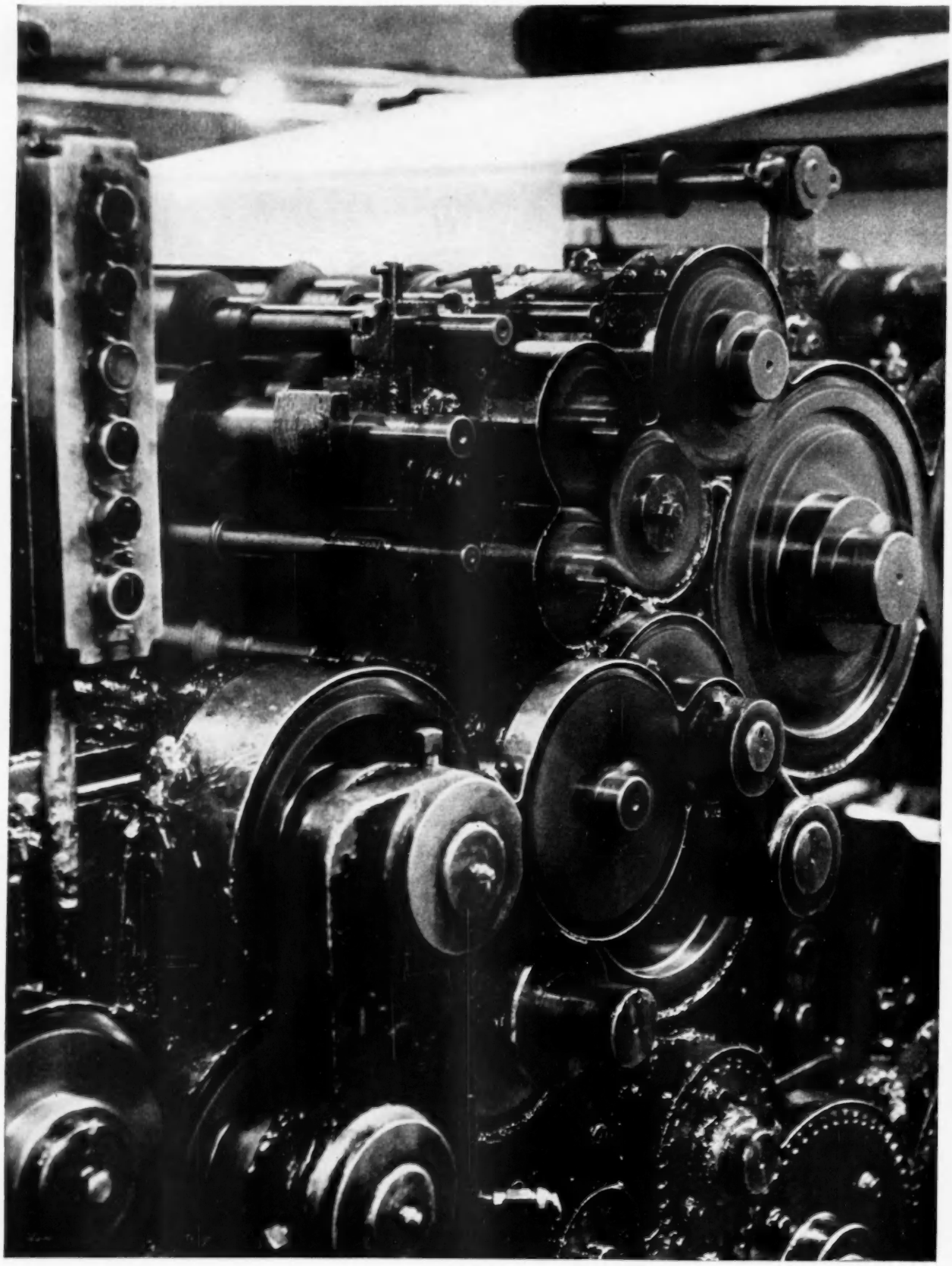
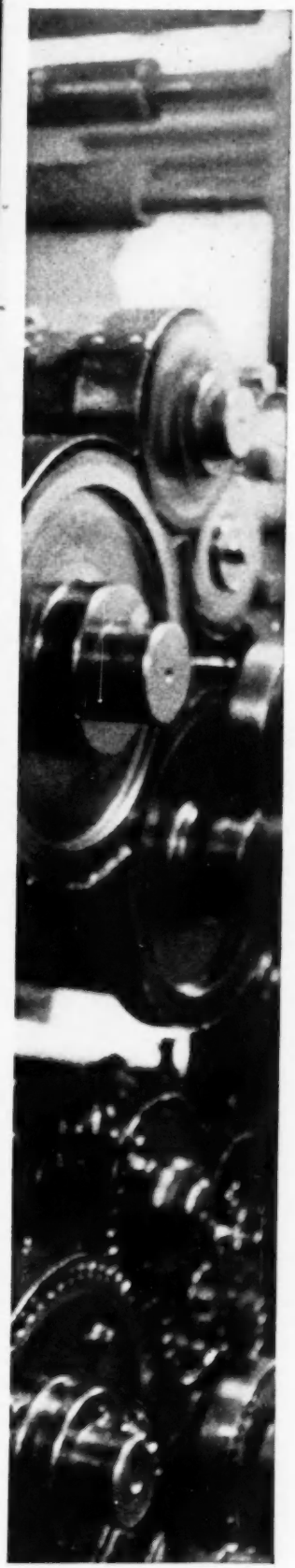


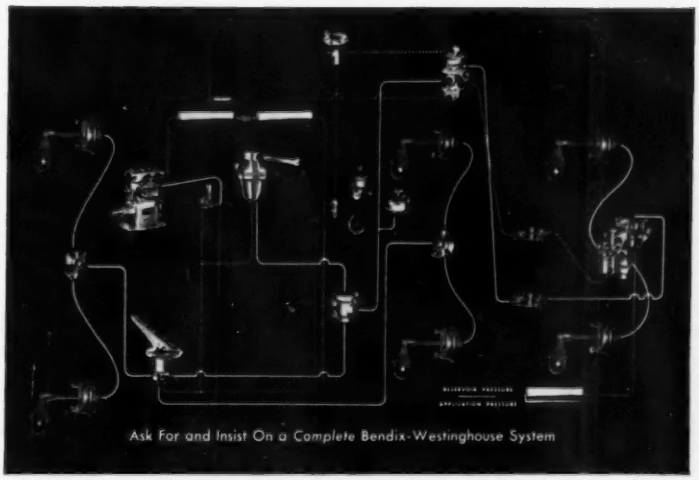


Dependable systems demand systems planning and engineering

Whether you're pressing the button that starts a 1,740 pound roll of newsprint through a modern, high-speed electronic press that prints, trims, sorts, folds and counts 50,000 newspapers per hour . . . or applying air brakes against the weight of a fully loaded vehicle, you can be sure of peak performance *only* when all of the precise and interrelated components in the system are *designed* and *engineered* to work together.

Air-brake systems could be assembled on a one-component-from-here, one-component-from-there basis. But for the most efficient, most reliable, most economical performance, you need a *complete chain* of components . . . every one designed and engineered to perform a specific function in a closely related system where each device is dependent upon another.

And that's what you get when you specify a Bendix-Westinghouse Air Brake System for your vehicles. Higher performance . . . longer life . . . lower cost . . . and Bendix-Westinghouse accepts full responsibility for the performance of the complete system. That's why more vehicles travel more miles with Bendix-Westinghouse Air Brakes than with all other air brakes combined.



Ask For and Insist On a *Complete* Bendix-Westinghouse System

SYSTEM—according to Webster: "Many parts connected in such a manner as to create a chain of mutual dependencies"

Bendix-Westinghouse

AUTOMOTIVE AIR BRAKE COMPANY

General offices and factory—Elyria, Ohio. Branches—Berkeley, Calif. and Oklahoma City, Okla.

There's almost no limit to the things Bundy can mass-fabricate

Bundyweld is the original tubing double-walled from a single copper-plated *steel* strip, metallurgically bonded through 360° of wall contact for amazing strength, versatility.

Bundyweld is lightweight, uniformly smooth, easily fabricated. It's remarkably resistant to vibration fatigue; has unusually high bursting strength. Sizes up to ⅝" O.D.

Whether it's a complex shape, or just a simple bend, Bundy knows virtually no bounds when it comes to mass-fabricating steel tubing. You see, Bundy engineers are tubing specialists . . . backed by never-ending, ever-bending experience. And here are just a few of the benefits you will derive.

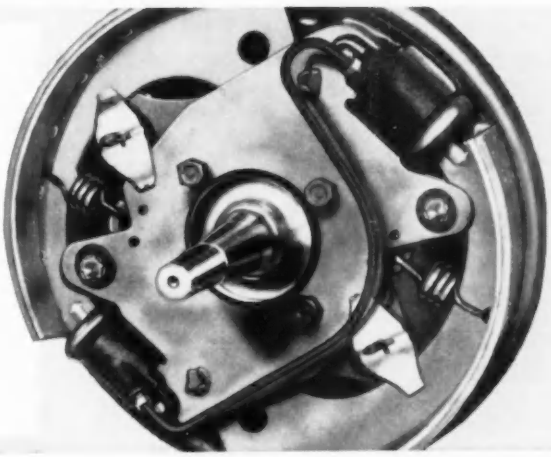
From a single strip of steel comes double-walled, copper-brazed Bundyweld® tubing—leakproof by test—and the tubing standard of the automotive industry. In fact, Bundyweld steel tubing is used in many applications in 95% of today's cars.

At any stage of product development, Bundy designers can be called in for consultation, and suggestions of time- and money-saving modifications.

For low unit-cost and uniformly high quality, Bundy-designed fixtures and machines are geared to mass-fabricate parts to *your* specifications.

Got a tubing problem? Better see Bundy *first!* Phone, write, or wire Bundy Tubing Company, Detroit 14, Michigan, today.

Another example of Bundy mass-fabrication. This internal hydraulic "snake" replaces mechanical brake linkage; provides safer, surer stopping. Double-walled Bundyweld steel tubing wears indefinitely; with high resistance to vibration fatigue.



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Jet fitting cup — LS-53
Synthetic lube diaphragm — LS-53
Diesel equipment seal — Viton
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For advanced fuel...hydraulic...lube systems,

New materials prove ideal in handling temperature extremes −350° F. to +750° F.

Working with two remarkably versatile elastomers, C/R Sirvene engineers are producing flexible molded parts for many vital fuel, lubricating, hydraulic and pneumatic systems. One, Viton-A*, can be compounded to produce parts that function dependably at 600° F., and for short periods up to 750° F. The other important feature of Viton compounds is their excellent resistance to corrosive chemicals, chlorinated solvents as well as both synthetic and petroleum base fuels and lubes. At the other extreme, C/R compounded Silastic LS-53** parts are providing low temperature operation down to -80° F. They also exhibit excellent resistance to synthetic and petroleum base fluids up to 350° F., and function well in propane up to 500° F. For temperatures as low as -350° F., C/R recommends Teflon* compounds.

C/R Sirvene engineers have an intimate knowledge of these elastomers. They also have perfected special techniques in processing which still further improve the physical properties of the molded parts. If your problem involves high or low temperatures, close tolerances, and compatibility in advanced design fuel, lubricant or hydraulic systems, get in touch with us at once. We have the skill and the facilities to help you.

* DuPont registered trademark
**Dow-Corning registered trademark

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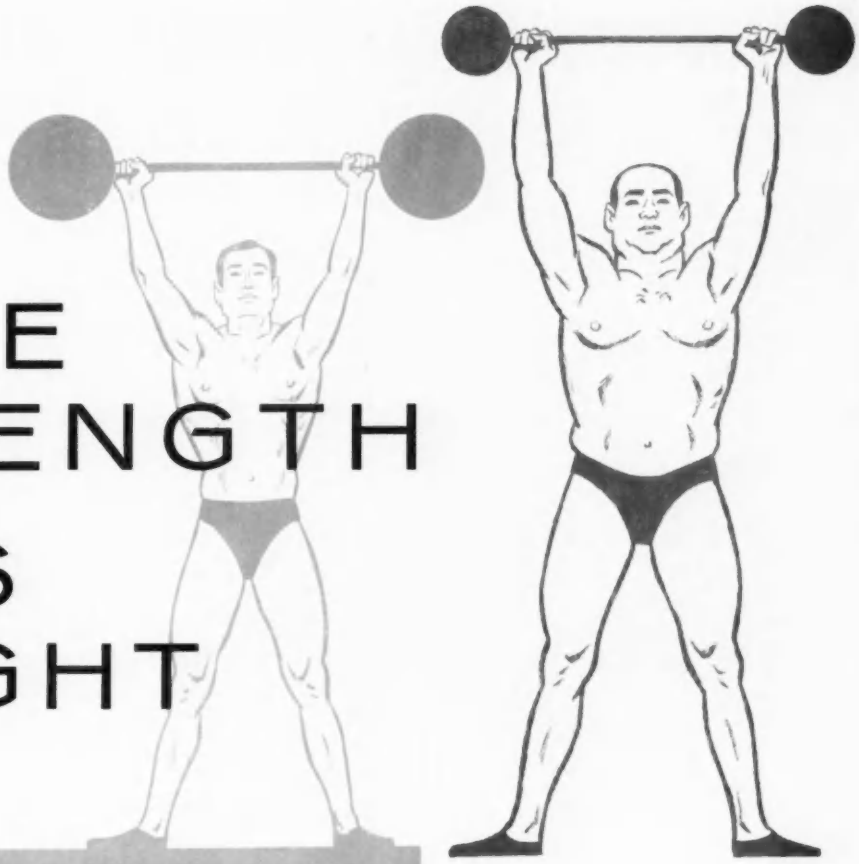

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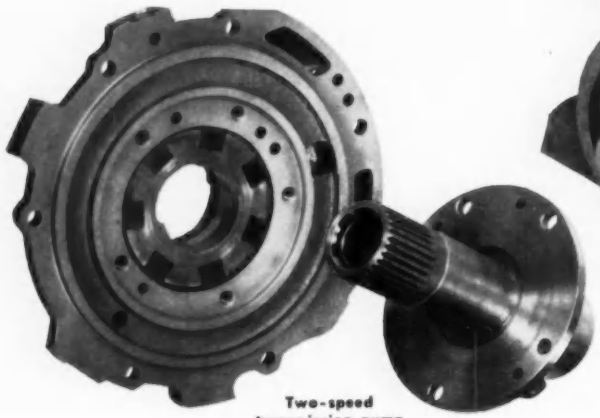
New slipper design packs a lot of hydraulic pump into a small package

Power steering pump



Two-speed transmission pump

Thompson Pumps for Power Steering, Transmissions and Industrial Applications are Compact, Efficient, Low Cost

This "slipper" is the main reason why new Thompson-Federal hydraulic pumps perform so much better and last longer . . . yet cost less.

Because it is wider, the Thompson "slipper" contacts the pump bore over a broad area . . . gives a better seal for greater efficiency and long service at high speed. Self-lubricating, the "slipper" glides on a film of oil.

The wide, strong "slipper" is self-aligning, doesn't need the support of a close fitting channel in the driving rotor. Thompson pumps maintain their high efficiency for a lifetime of use.

The Thompson "slipper" is short, permitting a more compact pump. And Thompson's novel porting arrangement produces a non-pulsating discharge for quieter operation over a wide speed range.

Thompson power steering and transmission pumps are giving excellent service in thousands of vehicles on the road today. For information on how Thompson pumps can help improve the performance of your products, write or call Thompson Products Michigan Division, Thompson Ramo Wooldridge Inc., 34201 Van Dyke, Warren, Michigan, JEfferson 9-5500.

AUTOMOTIVE GROUP

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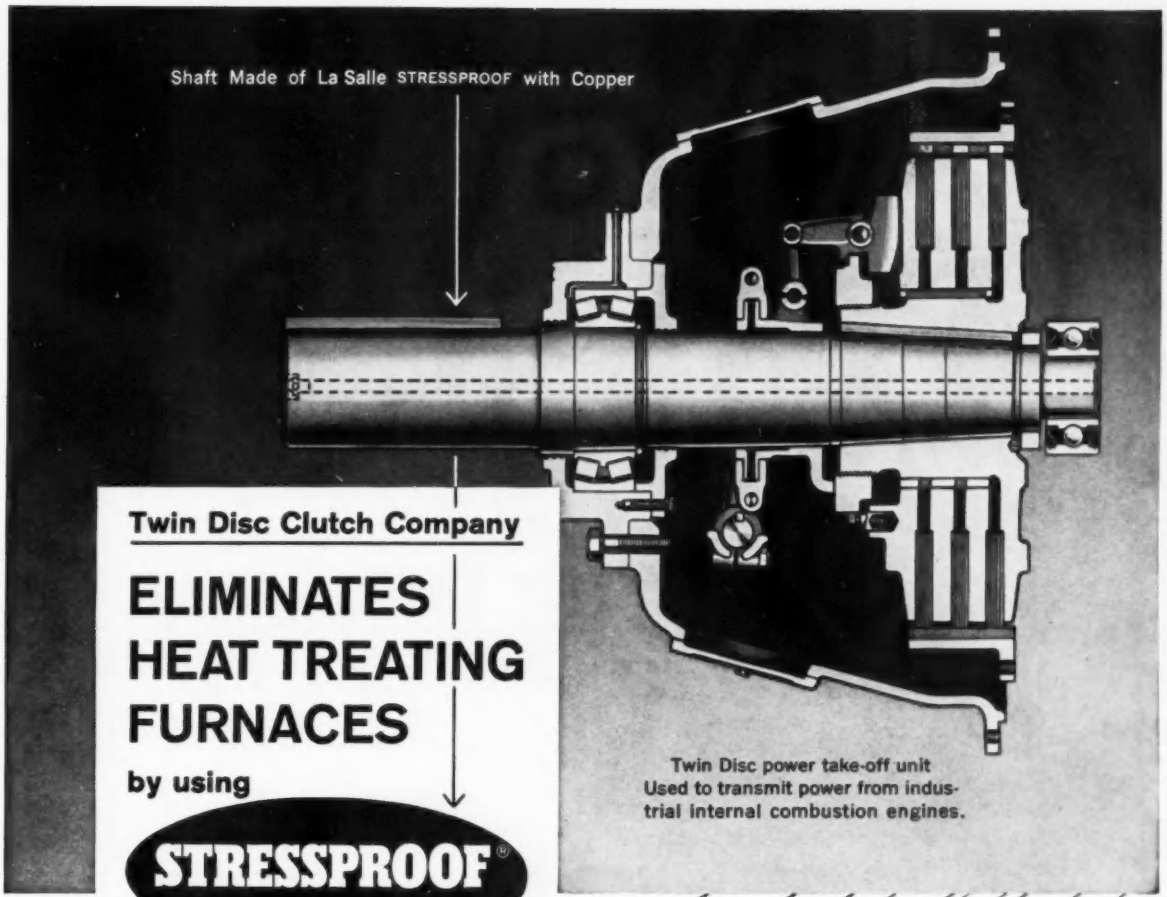


Twin Disc power take-off unit
Used to transmit power from industrial internal combustion engines.

Twin Disc Clutch Company

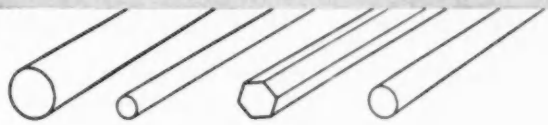
ELIMINATES HEAT TREATING FURNACES

by using

STRESSPROOF®

with copper

STEEL BARS



In Racine, Wisconsin, Twin Disc Clutch Co. saved money on a plant addition by eliminating heat treating furnaces . . . and they continue to save on part costs by using a material which needs no heat treatment . . . STRESSPROOF.

On the strength of over 15 years' experience with STRESSPROOF, Twin Disc knew they could cut their costs by purchasing this material which has the necessary properties in the bar.

They produce about 150 different models of power take-off shafts . . . see cross-section drawing. These shafts must possess great toughness and have the strength to take heavy loads. They must resist wear at the journals. Because one end of each shaft must be machined to individual customer specifications, machinability is important. Warpage after machining cannot be tolerated.

STRESSPROOF with copper fills these requirements on all counts because it has these four qualities in the bar: (1) Strength without heat treating. (2) Machinability (copper further improves machinability). (3) Excellent resistance to wear. (4) Minimum warpage.

By using STRESSPROOF, Twin Disc eliminates the cost of heat treating, cleaning and straightening. Working conditions are better . . . the plant is cleaner and cooler, and floor space requirements are less. Time and money consuming production steps are eliminated.

Twin Disc gets better parts at lower cost, and perhaps you can profit by their experience. Unless you have investigated STRESSPROOF recently, you may be overlooking worthwhile savings, especially since copper has now been added to improve machinability.

Available from your Steel Service Center.

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1438 150th Street, Hammond, Indiana

Please send literature describing La Salle STRESSPROOF with copper.

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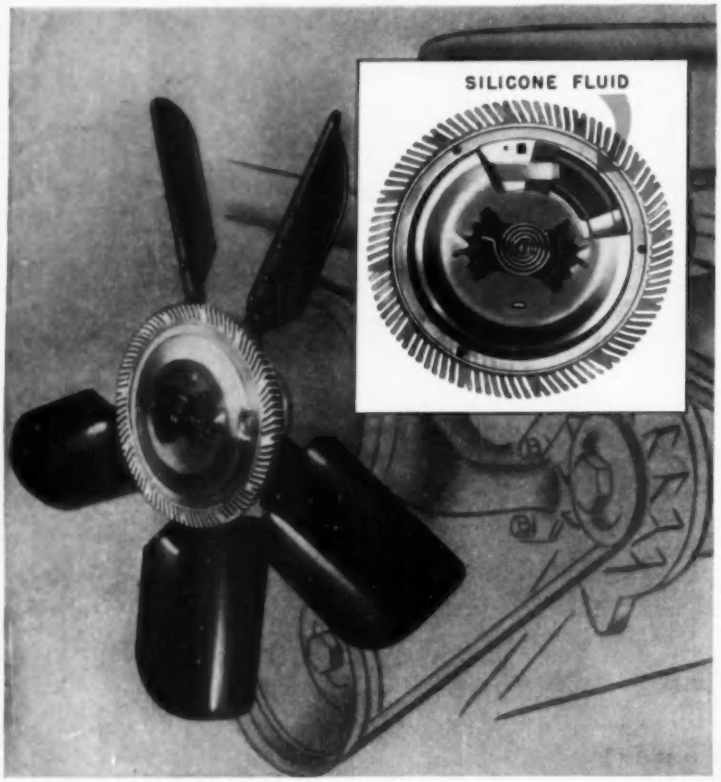
SILICONE NEWS from Dow Corning

Versatility For Designers

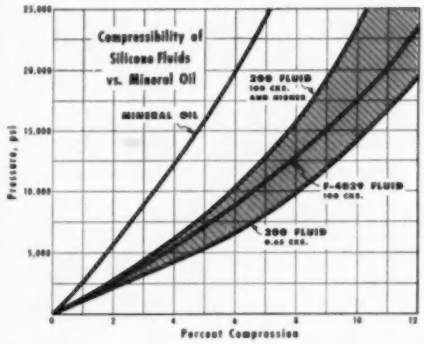


Silicones Improve Cooling Efficiency, Increase Horsepower, Reduce Noise

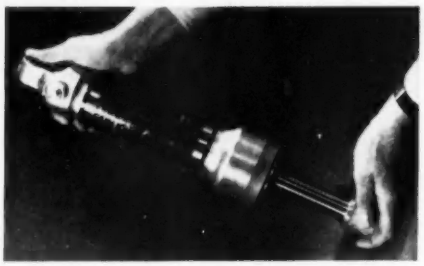
At high car speeds, engines waste valuable horsepower driving fans when cooling is least needed . . . yet fail to provide sufficient cooling at low speeds. Is there a solution to the problem? Yes, it's the temperature sensitive Visco-Drive developed by Eaton Manufacturing Company.

As underhood temperature rises, the automatically regulated Visco-Drive increases fan rpm to produce the required cooling; permits greater cooling efficiency at low engine speeds without the disadvantage of fan noise at high speeds.

Dow Corning 200 Fluid is specified as a viscous drive medium because it's many times more stable than petroleum-base oils. According to Eaton engineers, using a silicone fluid assures reliable, uniform performance over long periods of time under widely differing conditions. Such dependable performance is attributed to the fluid's unusual combination of properties — retention of near-constant viscosity over a wide temperature span; exceptional resistance to breakdown due to shear; and resistance to gumming and oxidation.



Compressibility Advantage. The exceptional versatility of Dow Corning silicone fluids makes possible many new designs—is also used to increase the efficiency of existing products. Compressibility at high pressure is an excellent example of a characteristic put to a practical advantage. Designers at Cleveland Pneumatic Tool Company developed "liquid springs" for the Lockheed F-104 Starfighter with 30% smaller oil chambers than shock absorbers that depend on organic fluids. Because the silicone fluid specified has much greater compressibility, it takes only 26 cubic inches of fluid to cushion each of the main landing wheels.



Uniform Damping. Miniaturization of instruments, from accelerometers to d/p cells, has been attained by effective use of silicone fluid as the damping medium. Improved performance is another benefit. Both are major advantages realized through the unique combination of properties available only from Dow Corning silicone fluids.

For your copy of the fact-filled, designers reference "Engineering Guide to Silicone Fluids", write Dept. 0620.

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

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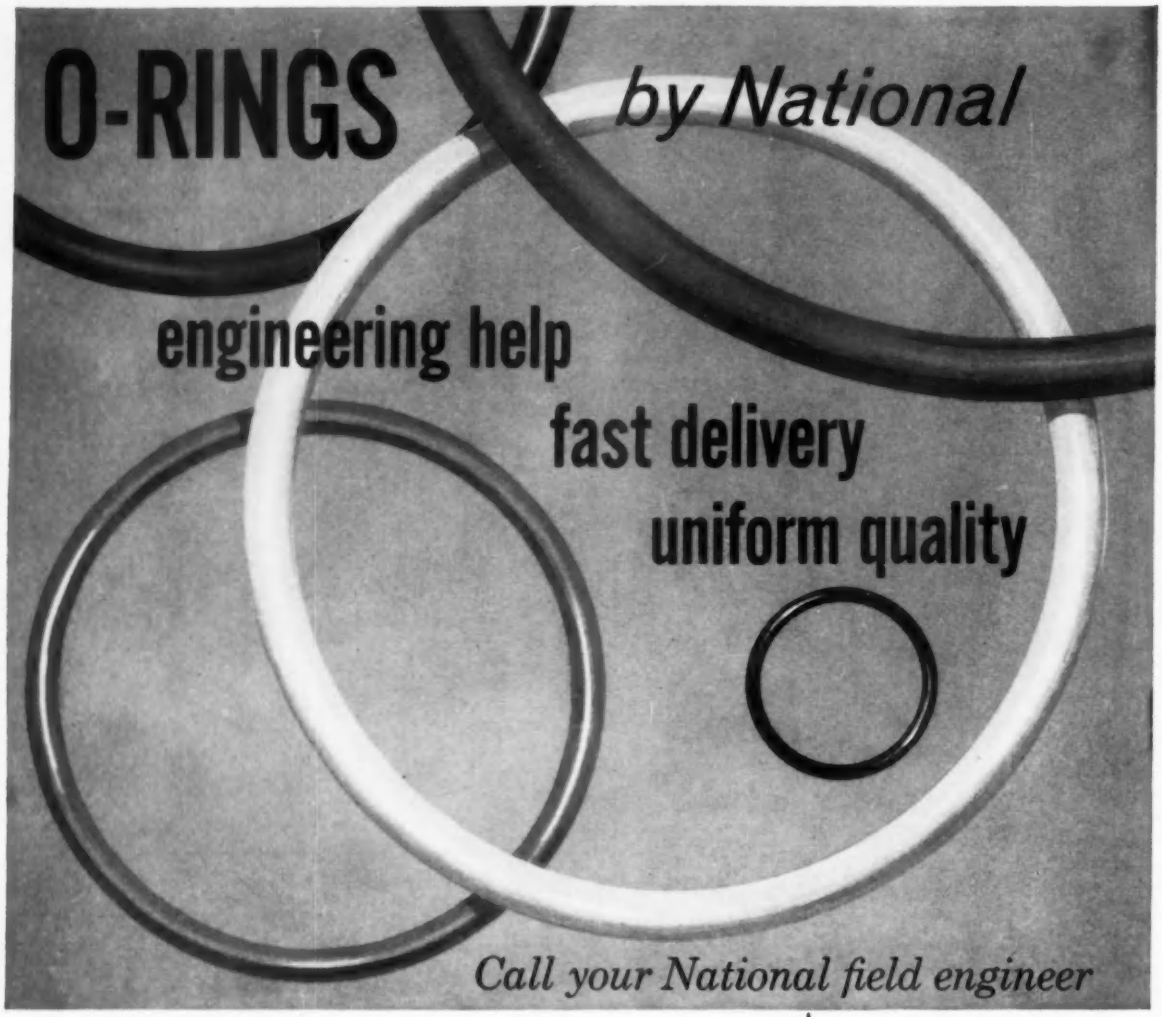

National O-Rings are precision made, uniform commercial rings available throughout the United States—promptly! Quality is superior; all ingredients are inspected before compounding and compounding is strictly controlled for maximum uniformity. Molding is done on modern equipment by veterans of 20 years in O-Ring manufacture. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

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(Advertisement)

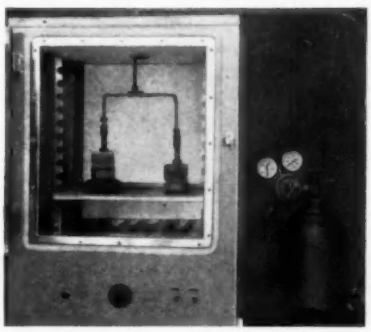
Technical data for gasket design and selection

Choosing a gasket for service under high heat, high loads

Combinations of elevated temperature and high flange loads—as found, for example, in compressor heads and automatic transmissions—often result in gasket extrusion and serious loss of bolt torque.

If internal pressures are also high, or contained fluids or gases may attack the gasket—as in refrigeration compressors—the service conditions become even more critical.

Accopac AN-890—a new beater-saturated asbestos gasket developed by Armstrong research—will seal under these rigorous conditions.



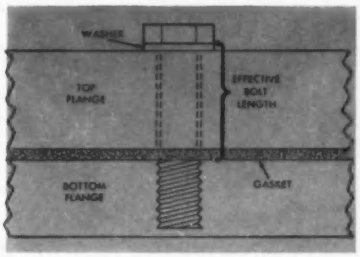
Laboratory test checks the combined effect of refrigerant gas and high temperature on Accopac AN-890. Flange at left contains refrigerant at 130 psi; flange at right contains no gas. After initial torquing at room temperature, flanges were heated to 300° F. and torque measured at 24-hour intervals for one week. Test showed no loss of torque on AN-890.

AN-890 is a blend of refined asbestos fibers and nitrile-type rubber that withstands temperatures up to 800° F. It will not crush or extrude under test loads of 100,000 psi at 300° F. And it has unusual torque retention and sealing properties in many applications where heat, high flange loads, and high internal pressures are encountered.

AN-890 is one of the line of Armstrong Accopac materials. It is available in rolls, sheets, ribbons, or die-cut parts. For more information, write for a copy of our folder IND-915.

How bolt length and initial torque loads affect torque retention on gasketed joints

To deal with problems of excessive torque loss in gasketed flanges—particularly those which operate at high temperatures—design engineers need to know (1) what the effect is of bolt length on maintaining torque; and (2) how the proportion of retained torque varies with the amount of initial torque.



Here, bolt length is defined as the distance from the underside of the bolt head to the face of the opposing flange—including compressed gasket thickness and any washer.

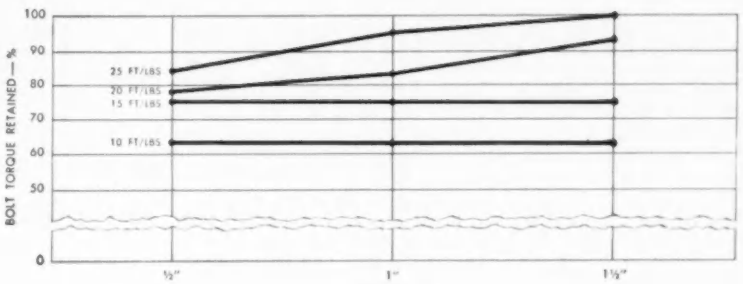
To get the answers to both questions simultaneously, Armstrong research engineers prepared separate steel flanges to accommodate three bolt lengths—½", 1", and 1½". (See diagram for definition of bolt length.) The flanges were gasketed with an Armstrong asbestos material—Accopac AN-890—in 1/32" gauge.

The bolts were torqued to specific loads at room temperature, and the flanges were placed in an oven at 300° F. After 18 hours, the torque was rechecked while the flanges were still hot. The results of this testing are shown on the chart below.

As this indicates, low initial torque loads lose proportionately more than higher loads. At 10 ft-lbs, for example, the average loss for all bolt sizes tested was 37%. At 25 ft-lbs, the average loss was about 8%.

The tests also show that longer bolts maintain torque better across the range of torque loads. The differences are, of course, more significant at the higher pressures. Although results in this direction were to be expected, the differences are surprisingly large.

If you have a specific problem related to torque retention on gasketed flanges . . . or any other question about the design, selection, or performance of gaskets . . . we will be glad to make suggestions to you. Send details to the address below.



Curves show % of initial bolt torque retained after 18 hours at 300° F. Initial torque is indicated at beginning of each curve. 5/16-24 NF hard steel bolts were used.

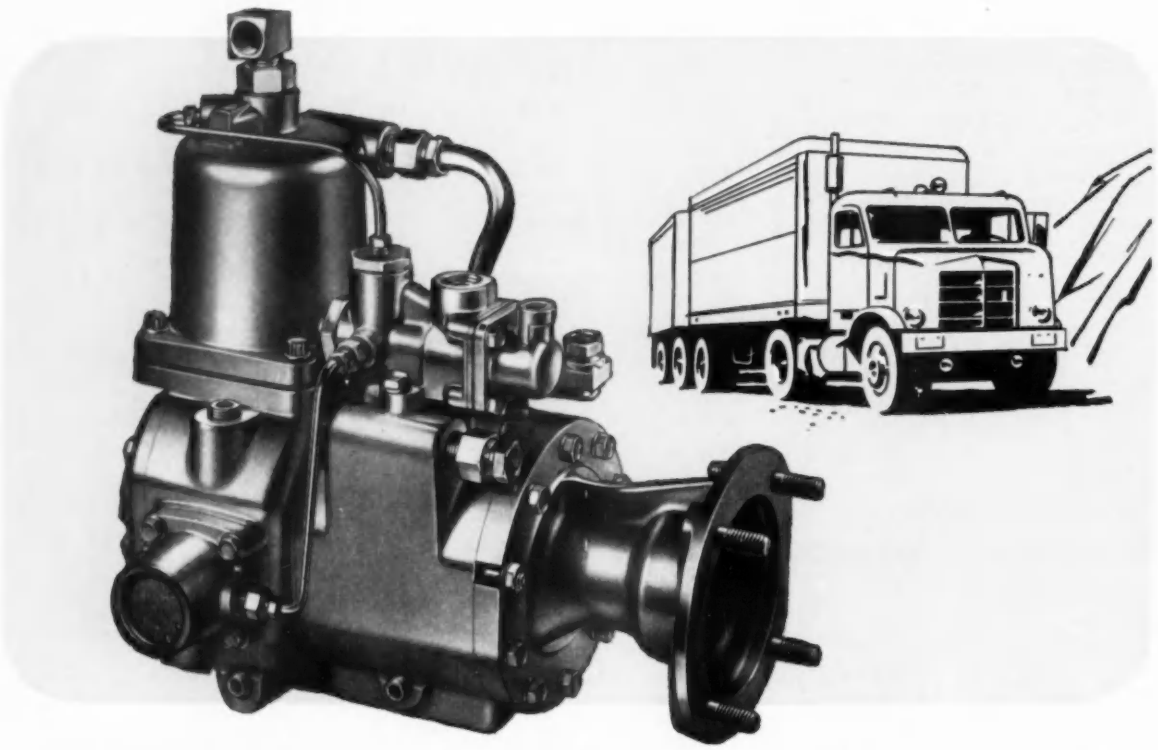
For your copy of our Gasket Design Manual, write to Armstrong Cork Co., Industrial Division, 7108 Imperial Avenue, Lancaster, Pa.

Armstrong GASKET MATERIALS

. . . used wherever performance counts

Circle 125 on Inquiry Card for more data

More air reserve for safer braking of diesel powered trucks...



with WAGNER ROTARY DRIVE-THRU COMPRESSORS

The Wagner Drive-Thru Compressor features all the advantages of rotary compression . . . supplies more air reserve for braking diesel trucks . . . gives rapid air pressure recovery with smooth, quiet, cool operation.

The design of the compressor eliminates the use of thrust absorbing components and makes it possible to use rotary seals with a minimum of seal loading. Improved channeling permits better oil circulation to all moving parts—lengthens the service life of the pump and cuts maintenance.

NEW LUBRICATING VALVE. The lube valve on these units circulates cool engine oil through the compressor during the non-pumping cycle and cools the compressor between cycles by completely changing the oil in the sump. Compressor life is prolonged by constant, adequate lubrication.

For full information on these compressors, write to Air Brake Engineering Department, Wagner Electric Corporation, St. Louis 14, Missouri.

WK58-B

Wagner Electric Corporation

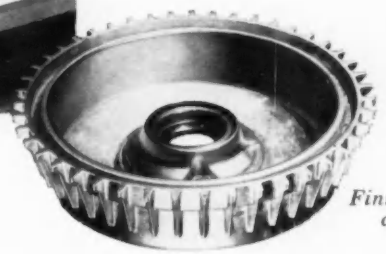
6363 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

LOCKHEED BRAKE PARTS, FLUID, BRAKE LINING and LINED BRAKE SHOES • AIR HORNS • AIR BRAKES • TACHOGRAPHS • ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES

For aluminum that's just right for your product...

Distributor cap inserts

Seat skirts and scuff plates



Finned brake drums

check with ANACONDA ALUMINUM

What is aluminum that's "just right" for your product?

It's aluminum carefully produced to your exacting specifications and shipped on schedule. And that's Anaconda Aluminum—aluminum in virtually any form, all custom-produced to insure that you're a satisfied customer.

Our custom production policy is made possible by the flexibility designed into all Anaconda Aluminum's modern plant facilities. Your order is scheduled promptly. And, from the moment it's written until it's shipped, your order gets the personalized attention of aluminum experts at every stage—another important part of this basic policy of making sure your aluminum is exactly right.

To fully meet your requirements, Anaconda Aluminum combines this small-shop personality with the facilities to supply you aluminum in many forms—pig and ingot, coiled and flat sheet, rod, bar, structurals, tubing and other extruded shapes.

What you want, when you want it—that's the kind of service we offer aluminum buyers. To get it, call your local Anaconda Aluminum representative, or write our General Offices, Dept. AI-8, Louisville 1, Kentucky.

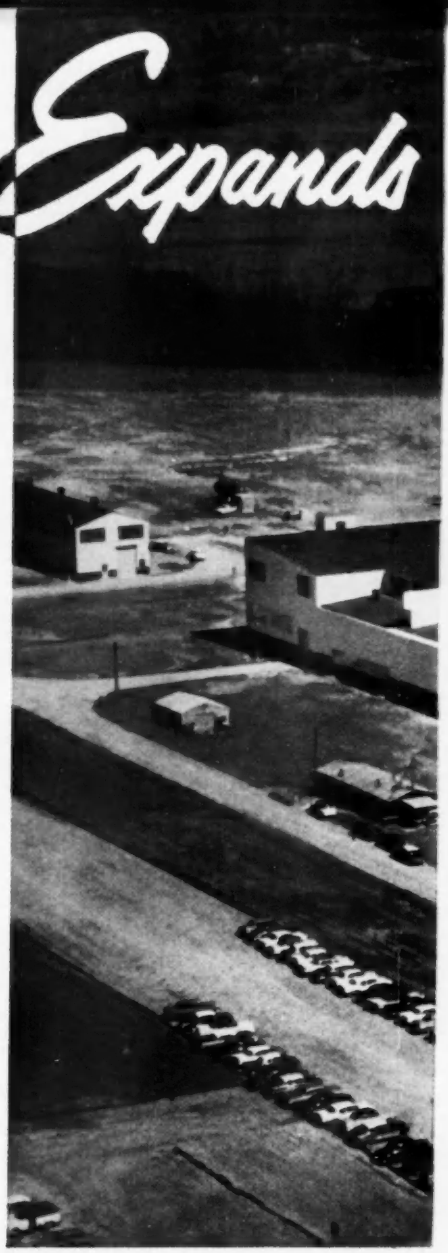
Every industry has one member who specializes in customer satisfaction

ANACONDA ALUMINUM

ANACONDA ALUMINUM COMPANY • GENERAL OFFICES, LOUISVILLE, KENTUCKY

UNIVERSAL-CYCLOPS STEEL *Expands*

. . . with a New Plant and New Cold Finishing Facilities at Coshocton, Ohio



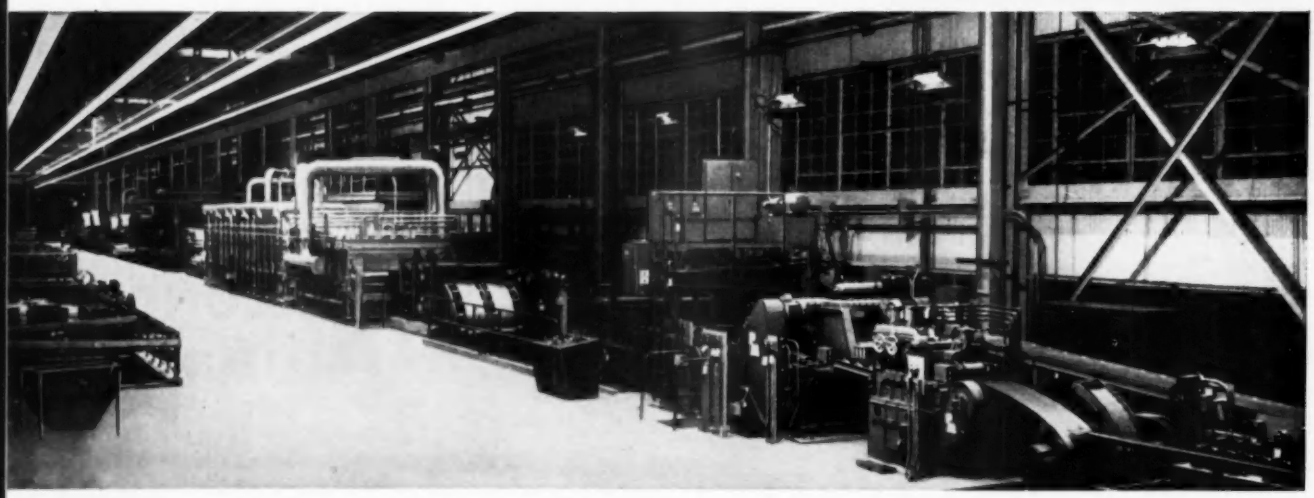
Universal-Cyclops, one of the leading producers of cold rolled stainless steel strip, announces the opening of a new plant at Coshocton, Ohio, which will supplement our facilities at Bridgeville, Pa., and greatly augment production capacity to meet the ever-increasing demands for UNILOY® Stainless Steel.

Completely new, this modern plant represents a major step in our corporate expansion program. It provides the finest facilities, production skills, engineering and metallurgical experience. It conforms to the policies maintained throughout our 75 year history, to constantly strive for highest quality standards in our products.

Customer oriented throughout, personnel and equipment are geared to meet the needs of our customers. Large stocks of finished coils are maintained at all times for prompt delivery.

UNIVERSAL CYCLOPS
UC STEEL
STEEL CORPORATION
Bridgeville, Pa.

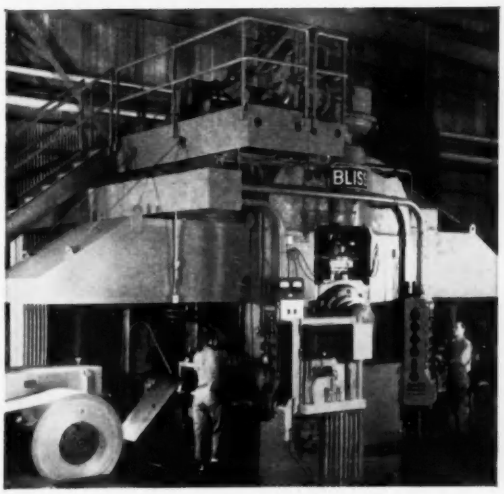
STAINLESS STEELS
TOOL STEELS • HIGH TEMPERATURE METALS



The most modern annealing and pickling line in the industry—over 600 ft. long. Handles two coils up to 24" width.

Circle 128 on Inquiry Card for more data

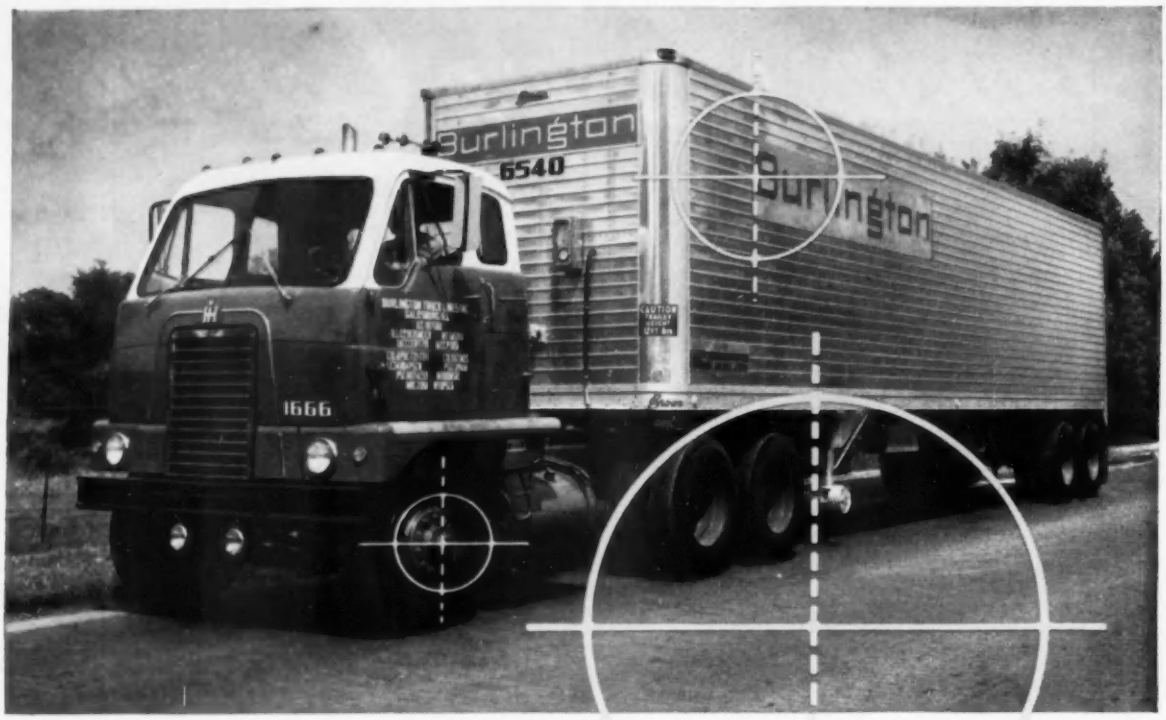
Stainless Strip Capacity



Modern four-high cold rolling mill.

Temper mill provides top quality finish.

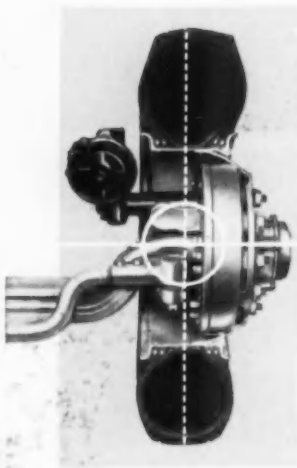
Large stocks of stainless steel coils—assure prompt delivery.



BURLINGTON TRUCK LINES SPECIFIES TIMKEN-DETROIT®

"center point" steer front axles

FOR 50 NEW TRACTORS!



When a major cross-country trucking firm like Burlington Truck Lines, Inc., puts its OK on a new type of axle for its vehicles, you can be sure that its approval is the result of careful checking. These advantages prompted Burlington to specify Timken-Detroit's new "Center Point" Steer Front Axles:

Easier steering—less weight, lower cost than with power assistance!

Safer operation—better vehicle control and less driver fatigue!

Same time-proved features which are available in all Timken-Detroit front axles.

With Center Point Design the king pin is placed in a true vertical position to eliminate the heavy front end "load lifting" that is normally required when turning the conventional axle. Steering resistance is reduced, and you get many of the advantages of power steering without the high original cost. Write today for full details.

Another Product of

ROCKWELL-STANDARD CORPORATION

ROCKWELL R STANDARD®

Transmission and Axle Division, Detroit 32, Michigan

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Circle 130 on Inquiry Card for more data →

the sales-making gleam of

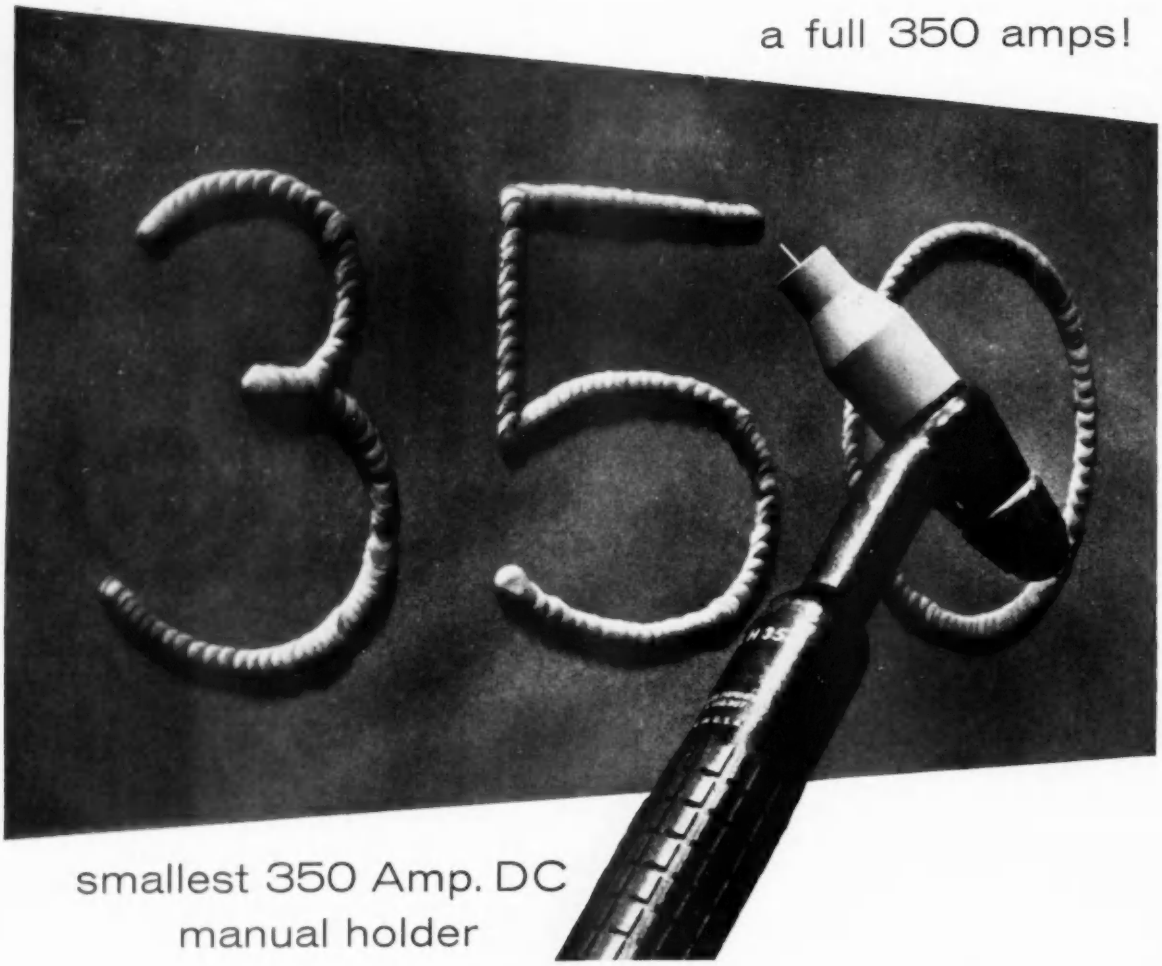
Superior Stainless

STRIP STEEL

At Chrysler Corporation, fine automotive engineering and fine motorcar appearance go hand-in-hand. That's why Chrysler specifies *stainless steel* for essential exterior brightwork where beauty must equal performance, year after service year. ● For over 25 years CHRYSLER has been a regular user of quality stainless strip steel from the mills of Superior Steel—a privilege and responsibility we are happy to uphold.

SUPERIOR STEEL DIVISION
OF
COPPERWELD STEEL COMPANY
CARNEGIE, PENNSYLVANIA
For Export: Copperweld Steel International Company, New York

a full 350 amps!



smallest 350 Amp. DC
manual holder

AIRCO'S H35-B HELIWELD HOLDER

new design • new light weight • new economy

Using tungsten electrodes as short as 2″ in length, the brand new Airco H35-B Manual Heliweld Holder can go to work in more confined spaces than any other holder.

It operates at a continuous duty rating of 350 amperes DCSP, or 300 amperes AC.

With a new Airco H35-B in hand you can heliweld stainless steel, aluminum, copper, magnesium and other alloys and metals . . . from paper-thin gauge to 1/8″ or more, depending upon the metal and current you use. Special body material insulates against high temperatures.

The Airco H35-B does the job at lower operating cost. Stub loss can be as little as 13/16″. Metallic nozzles are not needed. Reduced gas flow saves you money. Less down time, because there's no high frequency leakage. Connections are a breeze. For information see your Authorized Airco Dealer. He's listed in the Yellow Pages. Or, contact Airco direct.

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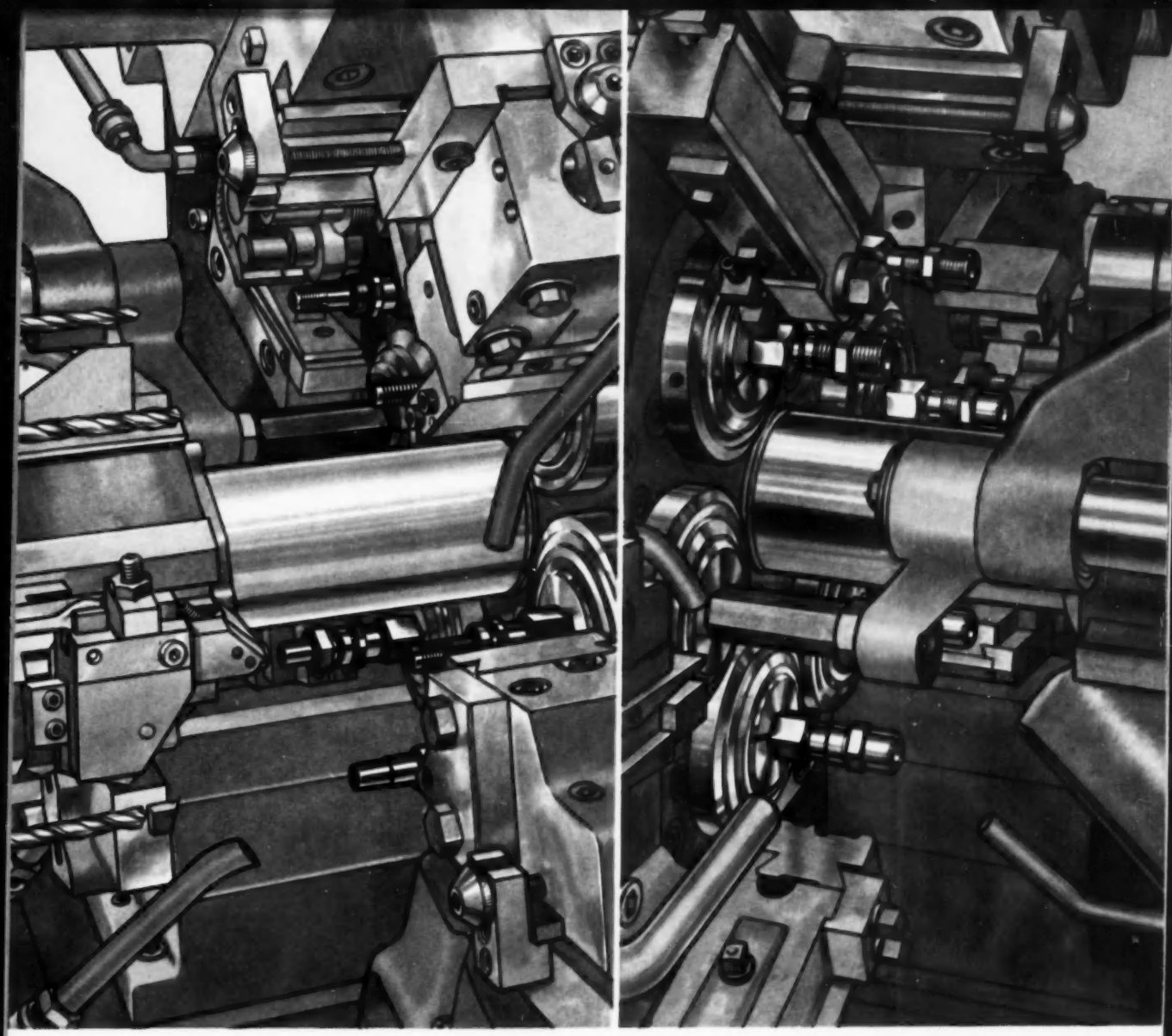
Circle 132 on Inquiry Card for more data

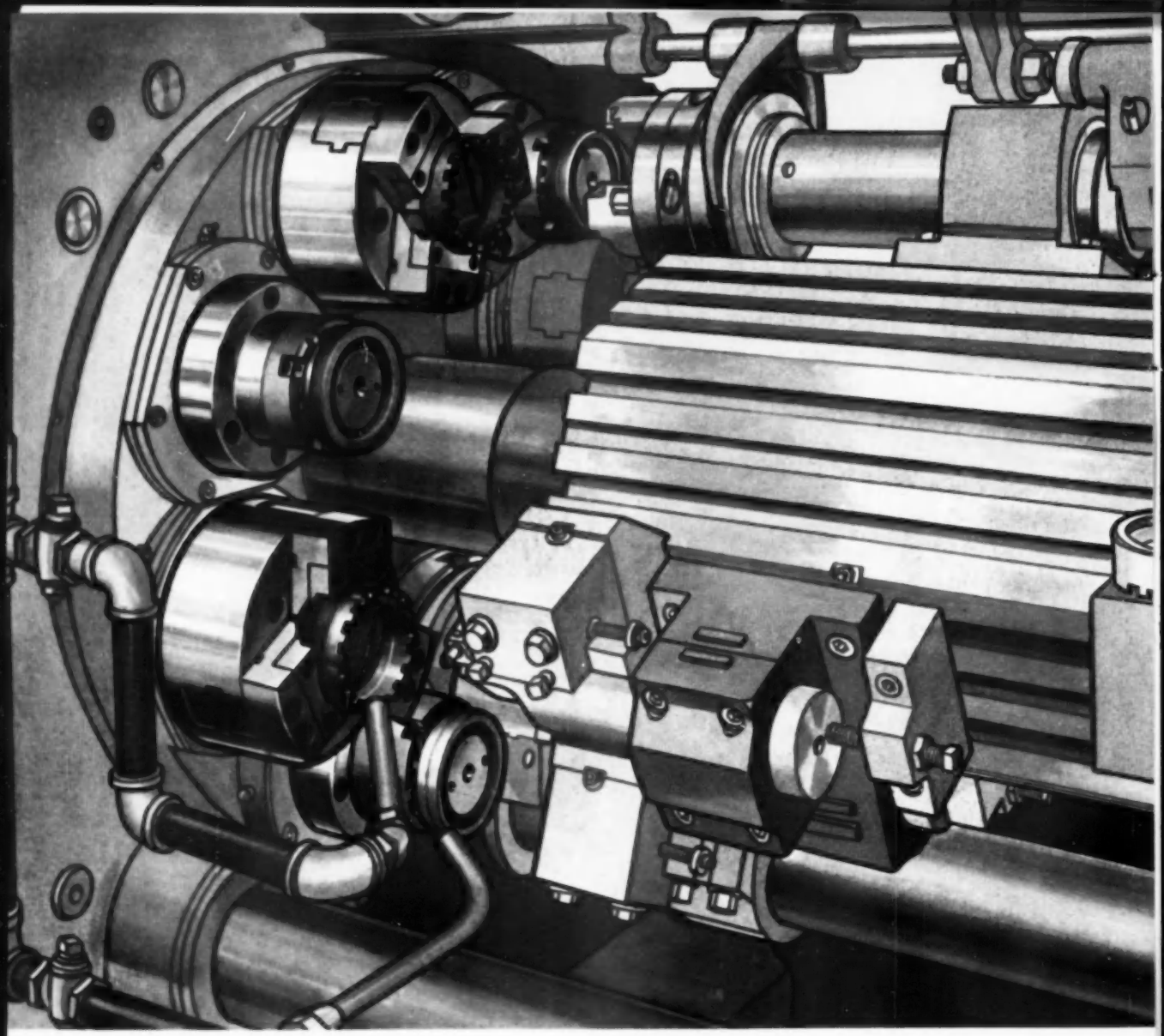


stainless, **225** *per hour—brass* **1500** *per hour.*

Up to a point increased machine productivity is a matter of refinements, additions, skillful tooling and perhaps more power. Eventually you achieve about all the efficiency that can be built into equipment of conventional design.

To achieve a major break-through in bar machine productivity necessitated redesign from the ground up. New Britain has done it with such success that we are able to offer the metalworking industry a whole new family of machines with performance unequalled anywhere. Independently cammed cross slides open up a whole new world of tooling possibilities. Power and spindle speeds are adapted to the important new metals and alloys. Increased chucking capacity allows application of New Britain standards of speed and accuracy to much larger pieces. None of the famous New Britain exclusive features which preserve accuracy and increase accessibility over other machines have been sacrificed. The chart below tells part of the story, and we have complete literature available to spell it out completely on the models which interest you particularly. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

Model	Spindles	Cross Slides	Spindle Speeds	Spindle Capacity	H.P.	Weight
45	4	4	43-526	5″	30-50	46,000
52	6	6	271-4250	1 1/4″	15-25	12,800
62	6	6	177-3000	1 5/8″	15-30	18,800
62	6	6	177-3000	2 1/4″	20-30	18,875
82	6	6	64-633	3 1/2″	30-50	46,000
83	8	6	99-1504	2 5/8″	30-50	46,000



open secret *of New Britain superiority.*

Wide-open design makes the most fundamental difference between a New Britain automatic chucking machine and other machines. It speaks for itself as a means of getting at the tooling, making adjustments and clearing chips.

Massiveness, right from the floor up, is equally apparent and equally important in chucker work. You see it in the way the cutting tools make the heaviest cuts with a chatter-free smoothness that can't be duplicated.

Only New Britain provides a combination of longitudinal with transverse forming motion where needed. This versatility eliminates the need for second operation machines in many cases —particularly when a job is setup for double indexing, as illustrated above.

New Britain spares no pains to incorporate every new development to make chucker-type machining more profitable. The open-end design lends itself particularly well to magazine loading and unloading, for example, and many New Britains are being equipped to provide this feature.

Whenever a number of operations are required on cast or forged pieces, these massive, rugged, powerful machines offer great possibilities for savings through faster, more accurate, more reliable production. A new and complete catalog on the New Britain chucker line is just off the press. We would be very glad to send you your copy. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NEWS

Vol. 121, No. 4 August 15, 1959

"Medium Small" Cars

Big Three Push Plans for Slightly Larger Version of Compact Car

Within a few weeks, details on the first of the Big Three small cars will be released officially to the public, and all three cars will be unveiled by the end of October.

No longer will Chevrolet, Ford and Plymouth merit the label of "low-priced three." The new Corvair, Falcon and Valiant will take over in that class.

Meanwhile, there's plenty of activity as all three companies push plans for slightly larger versions of their new compact cars. These cars (see AI March 15, p. 57) will be marketed by the medium-priced dealers. One Detroit automobile man calls the new group "hybrid small cars" or "medium-small" cars, since they will be larger than Corvair, Falcon or Valiant but still smaller than Chevrolet, Ford, Plymouth or even Dodge's new Dart.

Ford Steps Up Program

The cars, at least at GM and Ford, originally were scheduled for introduction in the fall of 1960 as '61 models. But Ford has accelerated its program and first production of the Edsel B (as it is now called) is slated for March. It will be introduced shortly after as a 1960 model.

This will ease the transition for Edsel from a standard-size car to a small car, with the two versions overlapping for several months. It also should give MEL Div. a jump on competition, since the Buick, Oldsmobile and Pontiac cars are not scheduled to come out until the fall. Some B-O-P tooling, however, already has been ordered.

Chrysler reportedly is working right along with plans for a larger Valiant for distribution by Dodge Div., although details are not as definite as on the Edsel B and B-O-P cars.

Edsel B (it undoubtedly will get another name) is being engineered as a 114-in. wheelbase car with overall length of 195 in. and width of approximately 68 in. The Edsel

U.S. RUBBER MAKES SMALL-CAR TIRE

E. N. Cole, left, Chevrolet general manager, and Walter D. Baldwin, U. S. Rubber Co. vice-president, view new 13-in. low profile tire designed as original equipment on the Corvair, GM's compact car. The new tire developed by U. S. Rubber engineers in cooperation with Chevrolet, will be produced in various sizes to meet the requirements of all small cars. Low profile tires are oval in cross section, give greater stability and better cornering power, according to U. S. Rubber.

B and Falcon will have common doors, under body and cowl and toeboard section, but Edsel will get its own flat roof panel, rear quarter panels and deck, and front end sheet metal. Plans call for two-door and four-door sedans and a four-door station wagon.

Falcon Engine

The car probably will offer both a six-cylinder and a V-8 engine, with the basic Falcon engine rebored for the six. The V-8 could well be Ford's 292 cu in. engine now used by both Edsel and Ford. An aluminum V-8 might be ready for 1962 use.

The B-O-P car will use the basic Corvair body, but each division is styling its own rear end and front end sheet metal. The car will have a 112 in. wheelbase and overall length of approximately 194 in.

New front and rear sheet metal and the extra front overhang will enable Buick, Oldsmobile and Pontiac to mount their engines in the front, instead of the rear, as Corvair is doing. The engine is a new aluminum block V-8 with around 200 cu in. displacement. Oldsmobile, however, in search of a little more power, might end up tooling its own engine for its X-100, as the car is now called.

The B-O-P car, like the Edsel B, is expected to offer a four-door wagon in addition to two- and four-door sedans.

Chrysler Corp.'s "medium-small" car is well hidden, probably at the company's Midland plant in Detroit. But the car, sharing the Valiant body, should have a wheelbase of about 111-in. and overall length of 193-196 in. This may be the car to receive Chrysler's aluminum six-cylinder engine, which originally was planned for the Valiant.

Dacron Tire Cords

Firestone Tire & Rubber Co. announced it has obtained excellent test results with passenger tires made of Dacron cord.

Raymond C. Firestone, president, said the tests showed that Dacron compared favorably in strength with any cord in use today, and gives increased mileage and improved strength.

In over a million miles of testing, Mr. Firestone added, no tires have failed because of flat spotting or from either adhesion or flexing.

Firestone's next step will be to equip automobile fleets in various parts of the country with Dacron tires to continue its testing program.

1960 Production Begins

Assembly of 1960 passenger cars is under way, with both Imperial and Corvair in production. By the end of August, all other Chrysler Corp. divisions will be building cars, and within a month nearly all U. S. assembly plants will be in full swing.

Corvair began regular production at Willow Run, Mich., early in August, and production at Kansas City and Oakland will follow later. Imperial began assembly Aug. 10.

When Chrysler's plants start up during the latter part of August, there will be a few changes. The Hamtramck Assembly plant, formerly known as Dodge Main, will turn out Dodge, Dart and Valiant cars only, and the Jefferson plant will build Chrysler and De Soto cars. The new St. Louis plant, replacing Evansville, Ind., will build Plymouth and Dodge cars, and possible Darts later on, if volume warrants.

Mercury plants will end '59 production during the Aug. 21-28 period and start up again Sept. 14. Edsel will phase out at Louisville Aug. 26 and also resume Sept. 14. Lincoln and Continental will shut down Aug. 21 and pick up with '60 models Sept. 8.

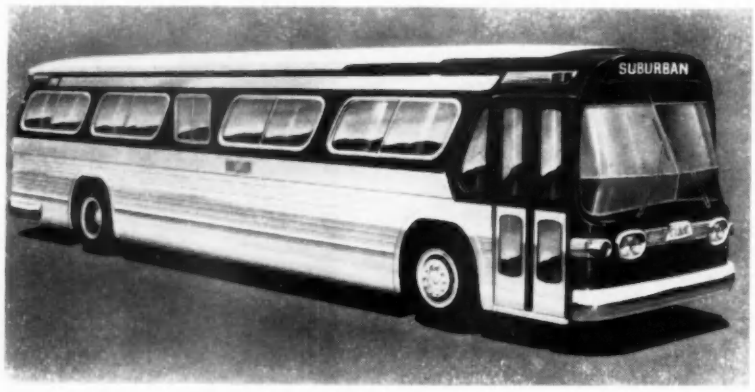
American Motors, Buick, Cadillac and Studebaker-Packard ended production Aug. 7 with Pontiac and Oldsmobile following Aug. 13 and 14. All are scheduled to resume the first week of September.

That leaves Ford Div. and Chevrolet, along with Mercury and Edsel, building '59 cars in the second half of August. Chevrolet and Ford both will shut down at the end of the month and start full-scale '60 production about the middle of September.

Electric Car Moves

Stinson Aircraft Tool & Engineering Co. of San Diego has moved its electric car around a bit. The company says the car will be built either in Japan or Germany, where manufacturing costs are lower than in California. The shift will delay production plans about 12 months. Stinson has built several prototypes of its battery car.

GM BUS POWERED BY NEW V-6 ENGINE



Two new suburban-type buses will be put into production early next year by the GMC Truck and Coach Div. Both the 45- and 53-passenger models will feature improved styling, a new heating system, a choice of three types of transmission, and an improved air suspension system. A new V-6 Diesel engine, with 4-valve head, develops 190 bhp at 2000 rpm and a torque of 550 lb/ft at 1200 rpm.

New Rust-Proof System

Chrysler Corp. will use a new body dip rust proofing technique on its 1960 Plymouth, Dodge, Desoto cars and Chrysler Valiant and Dart automobiles.

The new seven-stage system, installed at a cost of $18,000,000, at the corporation's body manufacturing plants, involves heating and cooling, rinsing, priming, and finishing.

The anti-corrosion cycle lasts one hour and 45 minutes, puts the bodies through a 2300 foot tunnel at the rate of 60 cars an hour. At peak production the primer tank contains 16,800 gallons.

The full cycle begins with coil and sheet steel, involves nine temperature changes in three metal cleaning baths, seven anti-corrosion dips, seven spraying operations, and seven external paint finishing operations.

Steel Shipments

Steel mills shipped a record total of 48,156,396 net tons of finished steel products during the first six months of 1959, according to American Iron and Steel Institute.

This is a gain of about 70 per cent over the 28,699,218 tons shipped in the like period a year ago and exceeds by over a million tons the previous record period, set in 1956 with a total of 46,933,786 tons.

Shipments to automotive users led all other classifications with a total for the period of 9,951,879 tons. This is more than double the 4,099,258 shipped in the like period a year ago and tops the previous record total of 9,612,069, set in 1955.

Total shipments during June were also at a record high of 9,700,456 tons, the institute reported. That total tops the previous monthly high (8,754,119 net tons, set in May, 1959) by more than 946,000 tons, and is about 69 per cent higher than the total for June, 1958.

HOW THE BALANCE OF U.S. TRADE SHIFTED IN CARS AND TRUCKS

First 6 Mos., 1958		First 6 Mos., 1959	
U.S. Exports	$307,375,457	U.S. Imports	$385,124,380
U.S. Imports	$226,028,367	U.S. Exports	$283,634,498
Plus...	$81,347,090	*Minus*...	$101,489,882

U. S. Imports of Cars, Trucks Top Exports

A report just released by the Automobile Manufacturers Association reveals some striking changes in the U. S. trade in automobiles and trucks. AMA figures show that the trade balance now has shifted against the U. S.

In the first six months of 1959, U. S. exports totaled $283,634,498, compared with imports (mostly from Western Europe) of $385,-124,380. For the like period a year ago our exports exceeded imports by a good margin—$307,375,457 in sales as against $226,028,367 in purchases.

The shift in unit sales and purchases is even more striking. In the 1958 period, U. S. exports totaled 71,594 cars and 77,301 trucks. Imports were 194,835 cars and 7603 trucks.

In the first six months of this year, U. S. car sales dropped to 59,405, while truck sales rose to 88,459. At the same time U. S. purchases jumped to 334,180 cars and 11,553 trucks.

For the month of June, 1959, U. S. exported 7744 cars and 17,-852 trucks for a total value of $46,-257,129. This compares with imports of 60,321 cars and 1868 trucks, having a dollar value of $67,318,650.

TRACTOR DESIGNED FOR TRUCK-TRAIN SERVICE

International Harvester Corp. is offering this new tractor, International model DCOF-405, for truck train service on toll roads. Standard powerplant is a 335-hp Cummins Diesel. A 375-hp turbocharged Harvester Diesel is optional. Other standard features: 160-in. wheelbase, 72-in. sleeper cab, tandem axle, and 12-speed transmission. Gcw rating is 127,400 lb.

NEWS

CONTINUED

New Norton Process May Cut Cost of Titanium

Norton Co. says it has developed a new electrolytic process that may result in cutting the cost of removing titanium from its ore.

The new technique was developed after seven years of work by a Norton Co. research team composed of Dr. Guy Ervin, Jr., Dr. Herbert F. G. Ueltz, and Malcolm E. Washburn.

Norton said the research team designed a pilot cell consisting of a graphite crucible lined with titanium carbide rings, which form the anode. The metal cathode is suspended in the crucible concentric with the anode.

During electrolysis, the titanium is separated from its carbide and sticks to the cathode in the form of tiny crystals of titanium metal having a purity in the order of 99.6 per cent. After the crystals are washed to remove the electrolyte, they can be melted into ingots for use as a metal or fabricated by powder metallurgy techniques.

One of the difficulties in working with titanium metal processes, Norton said, is that oxidation occurs at 900 C, the temperature at which electrolysis takes place. To overcome this, an atmosphere of argon is used.

The cathode is retracted into a gas-tight compartment over the cell, which serves as a cooling chamber as well as an "air lock" through which the batch is removed. Fresh cathode bars can be inserted into the cell in a semi-continuous operation until all the titanium in the anode is used up.

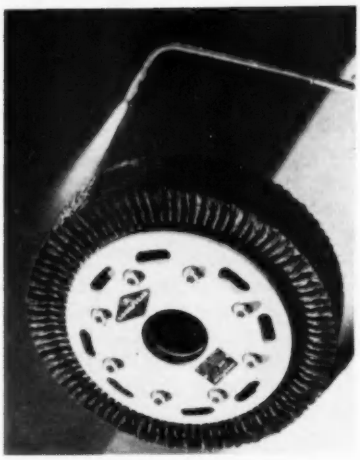
Although the experimental cells were not large enough to allow Norton to estimate the cost of production equipment, company officials said they were confident the process would be economical.

One reason for their confidence, they said, is that titanium carbide costs about the same as titanium tetrachloride and contains about three times as much titanium. Titanium tetrachloride is used as a starting material in present commercial processes.

The process still lacks a technique for removal and replacement of used anodes that would make continuous operation possible, Norton said.

The process is also designed to produce other metals, such as niobium, vanadium, chromium, zirconium, tantalum, hafnium, molybdenum, thorium, and tungsten.

SPACE TIRE



Goodyear Tire & Rubber Co. has developed this all-wire tire for use in space flights. It withstands temperatures up to 2000 F and has load deflection characteristics very similar to those of pneumatic tires. Tire and wheel weigh about 40 lb and can be made of various alloys, depending upon the application. New tire will be tested by NASA for possible use in the Dyna-Soar program.

Chrysler Opens Plant

Chrysler Corp. will reactivate its idle Wyoming plant on Detroit's west side the first week in September. The 280,000 sq ft plant, formerly used for De Soto assembly, is being converted to a central staging area for knock-down export shipments of all corporation passenger car lines, including the new Dart and Valiant cars. Dodge truck export shipments also will be made from the plant.

Through the '59 model run, Chrysler's KD shipments went directly from the various manufacturing plants scattered about the Detroit area. The new arrangement will consolidate body, engine, glass and other component shipments to all overseas assembly plants in 11 countries. The plant, which will be in full operation by mid-October, will employ about 300.

Some miscellaneous shipping, including tooling, machinery and non-productive materials needed in overseas plants, has been under way since mid-July.

Eight basic assembly lines, each about 100 ft long, will be fed the components needed for completed automobiles. But the parts will be crated instead of assembled. Most of the boxed units will be shipped out of the Port of Detroit during the Lakes shipping season. Cuba and Mexico shipments will be loaded directly on railroad gondolas.

Chrysler moved its entire De Soto operation out of the West Side complex at the end of the 1958 model year. The Warren Ave. engine and assembly plant was taken over by Imperial last year, and work currently is under way to convert the McGraw stamping plant to glass fabrication. This plant will be ready by Jan. 1.

John Fritz Award

The John Fritz Medal Board of Award announced that the top prize of the engineering fraternity will go to Gwilym A. Price, board chairman of Westinghouse Electric Corp.

The gold medal award will go for the first time in its 58-year history to a man with a non-engineering background for his leadership in the development of atomic power, the award board said.

The presentation will be made at the annual meeting of the ASME at Atlantic City in early December.

Circle 133 on Inquiry Card for more data ——→

MIDLAND DUPLEX VALVE – Controls for the Growth of a Nation

Midland products include:

Air brakes for the truck and trailer industry
Vacuum power brakes for the automotive industry
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(Advertisement)

BEARING BRIEFINGS

One in a series of technical reports by Bower

ROLLER GUIDANCE– VITAL FACTOR IN BEARING LIFE

Roller guidance has been established by the Anti-Friction Bearing Manufacturers Association as a major rating factor for roller bearings. There is a direct relationship between this factor and the life and capacity of a cylindrical roller bearing under load.

Figure 1 illustrates the results of a loose fit between a roller and the guiding ribs of the raceway. Because of lack of guidance by the ribs, the roller is free to skew and skid under load. Such a condition invariably leads to early bearing failure.

To achieve close roller fit and proper roller guidance, Bower precision grinds each bearing race on specially designed centerless grinders. In this operation, Bower positions the integral raceway ribs *from the theoretical centerline of the bearing.* This method produces bearings with high dimensional accuracy and perfect symmetry.

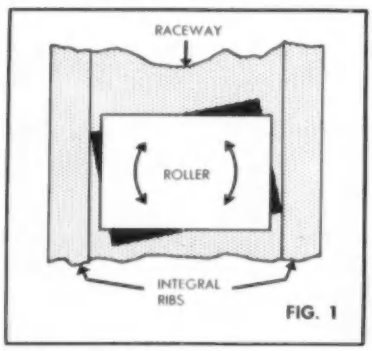
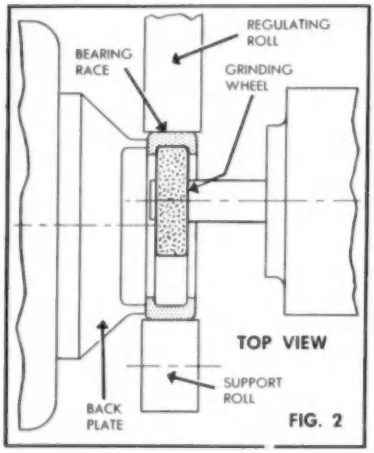
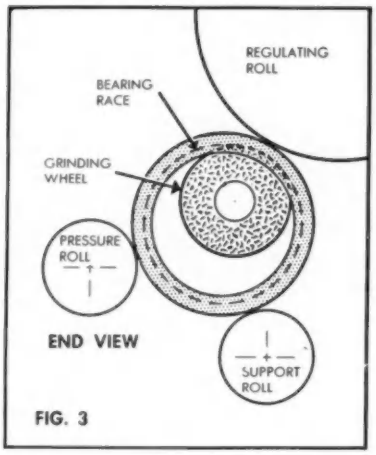


Fig. 1. Loose fit in raceway means poor roller guidance. Roller can skew and skid under load.

In addition, the close tolerances held in grinding the roller track and integral guiding ribs give Bower cylindrical roller bearings the ability to *take thrust in any direction.* A Bower cylindrical roller bearing has thrust capacity of from 10-15% of its rated radial capacity!



Figures 2 and 3 diagram the centerless grinding method used to finish Bower raceways. Use of this technique assures not only optimum roller guidance and maximum bearing life, but also virtually eliminates bearing runout. BEARING SYMMETRY WHICH RESULTS FROM THIS TECHNIQUE PERMITS ACCURATE SHAFT LOCATION REGARDLESS OF HOW THE OUTER RACE AND ROLLER ASSEMBLY ARE INSTALLED. IT COMPLETELY ELIMINATES THE POSSIBILITY OF IMPROPER INSTALLATION.



★ ★ ★ ★

Whatever your bearing needs, we suggest you consider the advantages of Bower bearings. Where product design calls for tapered or cylindrical roller bearings or journal roller assemblies, Bower can provide them in a full range of types and sizes. Bower engineers are always available, should you desire assistance or advice on bearing applications.

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION – FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICHIGAN

Circle 134 on Inquiry Card for more data

Circle 135 on Inquiry Card for more data

Call Crucible for stainless of uniform excellence

The lustre of Crucible stainless is achieved through precision-rolling on modern mills. Uniform physical properties are maintained by checking each heat — while electronic measuring controls ensure accurate gauge. Such methods produce coil after coil of uniform excellence. For stainless in all gauges down to .010" and in all strip widths, call or write: Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

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Whirlpool Corporation reports: among 598,265 components supplied by Amplex the first 4 months of 1959, there were only 5 rejects!

Quality, Delivery, Price...
this Amplex philosophy enables our customers to cut their production and warranty costs.

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* *Quality-Delivery-Price vs. Price-Delivery-Quality*

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NEWS

FEATURES

Defense Sales Drop

Big Three defense business fell off sharply during the first half of 1959, reflecting current missile-oriented thinking in Washington. Ford, Chrysler and General Motors did a total of only $397.2 million in Government military business through June, compared with $555.5 million a year ago.

The emphasis on missile development is reflected in the dollar totals of all three companies. Chrysler Corp., knee-deep in missiles, showed an increase of nearly $40 million. Ford phased out a jet engine contract in January, and total sales fell $144 million. GM's government business is spread wide but too thin, and sales fell by $59 million.

Chrysler Sales Up

Chrysler, prime contractor on both Jupiter and Redstone missile production, boosted its defense business from $126 million for the first six months of '58 to $165 million. Most of the gain came in the second quarter, when sales jumped from $55 million to $85 million.

Chrysler also has a comfortable cushion of medium tank business under contract.

But Ford's six-month defense sales fell from $188.5 million in 1958 to $44.2 million this year. Almost all of Ford's total of $373 million in 1958 were in the defunct Pratt & Whitney J-57 jet engine, which Ford built in Chicago.

Hence, the bulk of Ford's first half business was in military ground vehicles. The current period, however, will reflect government business contracted with Ford's newest operating division, Aeronutronics Div. The division, formerly a subsidiary, has a $23 million development contract and should pull more.

GM half-year defense sales tumbled from $241 million to $188 million this year. The second quarter showed a drop from $126 million to $95 million. GM has some missiles business, notably at AC Spark Plug, but not enough to boost the total.

For all of 1958, the company's defense sales totaled $455.5 million. Total Big Three military sales last year: $1153.4 million.

GM CHEMISTS STUDY SMOG

GM Research Laboratories chemists hope to learn more about smog formation with this long-path infrared cell. Mixtures of nitrogen oxides and various hydrocarbons found in the atmosphere are irradiated with artificial sunlight in the cell (right) to check photochemical reactions. The study is part of a joint automotive industry effort to fight smog.

Bendix Gets Contracts

Bendix Aviation's Friez Instrument Div. has received contracts totaling more than $2.5 million for production of some 125,000 radiosondes — airborne meteorological equipment that transmits temperature, humidity, barometric pressure and other data from upper atmosphere to aircraft or ground receiving stations.

Air Conditioning

Oldsmobile reports installation of 50,924 air conditioning units in the model year through June 30, for a 16 per cent rate. This compares with 36,941 a year ago.

AI TABLOID

Nothing less than 99.9996 per cent reliability is permissible in missile components, says Planes-Aerospace, official publication of the Aerospace Industries Association of America. For example, if a missile has 1000 critical parts, each with a reliability factor of 99 per cent, the missile itself would have a reliability of less than 1 per cent—that is, it would fail 99 times out of 100.

* * *

Dow Chemical Co. formed a new division for the fabrication and semi-fabrication of magnesium, aluminum and other metals. The new division, known as Dow Metal Products Co., replaces the Dow Magnesium Products Dept., which was devoted almost exclusively to magnesium.

* * *

Henschel-Werke G.m.b.H. of West Germany announced it will enter the U. S. market with a complete line of Diesel-powered trucks, as well as Diesel engines, buses, machine tools, and plant equipment. Henschel recently signed a mutual technical development and manufacturing pact with Bell Aircraft Corp.

* * *

Westinghouse Electric Corp. is forming an astronuclear laboratory for the development of nuclear energy for outer space. The new facility will be located in Pittsburgh, Pa., and will be part of a new Westinghouse atomic power division that will seek to develop commercial applications of atomic energy for electric power generation.

* * *

Harvey Aluminum has developed a new process, called Anocote, that protects aluminum extrusions from superficial corrosion during routine shipping, storing, and handling. The Anocote treatment, which requires special production steps and metallurgical techniques, is being offered as a company service, Harvey says.

The Marine Corps has started testing three Gyrodyne YRON-1 one-man helicopters (rotocycles) for reconnaissance, artillery observation, wire laying, and other combat tasks. The YRON-1 weighs only 425 lb and can carry a 265-lb payload, including pilot and fuel. It is powered by a 4-cylinder, 62-hp Porsche engine that drives twin counter-rotating rotors. Cruise speed is 60 mph, range 60 miles.

* * *

Friez Instrument Div. of Bendix Aviation Corp. has designed an absolute pressure switch that has only one moving part and can open or close an electrical circuit automatically. Called Bendix Pressurmite, the device consists of two precious metal contacts—one welded to a pressure-sensing diaphragm, the other attached to a threaded bushing. The unit is designed to detect critical pressure losses and to actuate control and warning systems.

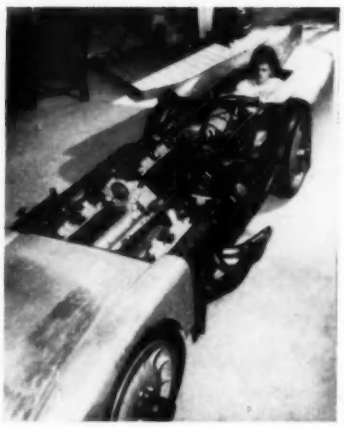
* * *

A sports cab that fits on a GMC wideside pickup truck and can be installed in only a few minutes is being offered by GMC truck dealers. The interior measures 53 in. high, 74 in. wide, and 98 in. long, has two six footer bunks. The cab fastens securely to the wideside box with six bolts and can be hoisted on or off quickly by means of two skyhooks. Suggested retail price of the unit installed at the factory is $500.

* * *

The Dept. of Commerce has published a list of some 100 Soviet technical journals now available in English abstracts, covering such fields as aeronautics, electrical engineering, fuel and power, metallurgy, general science and technology. The listing, English Abstracts of Russian Technical Journals, may be ordered without charge from Office of Technical Services, Dept. of Commerce, Washington 25, D. C.

2000-HP CAR



Mickey Thompson sits in the driver's compartment of the streamliner in which he will make his assault on the 12-year-old record of 394 mph this September at Bonneville Salt Flats, Utah. Car is powered by four 500-hp Pontiac synchronized engines, each driving its own wheel. Engines have a 13 to 1 compression ratio.

Car Without Wheels

GM's Research Laboratories Engineering Mechanics Department has devised a vehicle that can simulate all the bounce, pitch and roll of a passenger car traveling a bumpy road. The Ride Simulator, controlled by an analog computer, consists of a standard body without wheels or engine.

The simulator solves many complex suspension problems formerly handled by driving prototype cars on proving grounds and public highways, according to Robert H. Kohr, vehicle dynamics supervisor for the department.

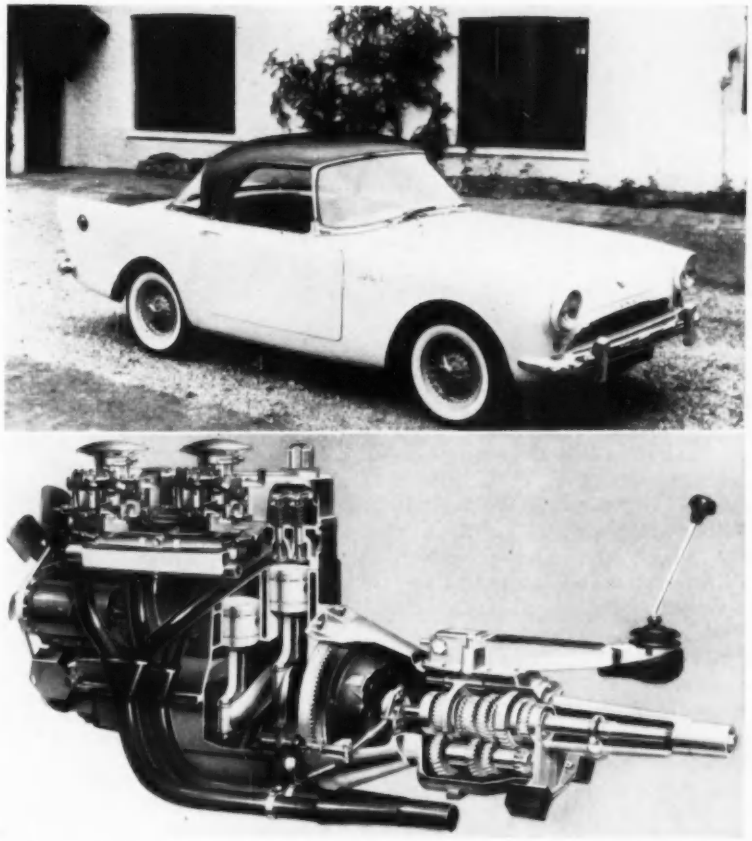
A tape recorder provides road wave inputs for the system. Car speed is related to tape speed. The analog computer determines, from the tape signals, what car motions will result. A motion simulator, driven by electro-hydraulic servomechanisms, reproduces the car motions on the standard car body. Output voltages from the computer control the motion simulator.

Sunbeam Alpine Revived

The Rootes Group has joined up with Bristol Siddeley Engines to revive the Sunbeam Alpine. Bristol Siddeley will make the body and do the final assembly.

The new sports car is built on an 86-in. wheelbase and is powered by Rootes' basic 91.2-cu in. engine tuned to deliver 83.5 bhp at 5300 rpm. Powerplant modifications include an aluminum cylinder head with 9.2 to 1 compression, twin Zenith carburetors, and a dual exhaust system.

The close-ratio four-speed gearbox is available with overdrive. Girling 9.5-in. disk brakes in front are combined with drums on the rear wheels. The folding top stows in a concealed recess, and a detachable hardtop is available.



Sunbeam Alpine is powered by Rootes' basic 91.2-cu in. engine and is available with soft top or detachable hardtop

New White Models

White Truck Div. is offering a new series of medium trucks and tractors in the 22,000-40,000 GCW class. The 2000 series trucks are available in three wheelbases—150, 170, 185 in.—with CA dimensions of 85⅝, 105⅝ and 120⅝ in. The 2000T series tractors are available in 130 and 150 in. wheelbase and CA lengths of 65⅝ and 85⅝.

The White OA-130 hp gasoline engine is standard equipment, the OA-145 is optional.

GM Sales Soar

General Motors sales for the first half of 1959 soared to $6512 million, just $1 million below the six-month record set in 1955. Earnings totaled $590 million, substantially below the 1955 profit of $661 million.

Both sales and earnings were well ahead of last year, when the totals were $5121 million and $334 million.

Second quarter sales totaled $3306 million and net income was $297 million. A year ago these figures were $2400 million and $149 million.

GM reached its near-record six-month sales figure with unit sales of 2,309,711 cars and trucks throughout the world, or 26 per cent over last year. Second quarter sales of 1,178,231 units were even better, topping 1958 by 38 per cent.

Six-month sales included 1,840,142 U. S.-built vehicles, a gain of 30 per cent, and second-quarter domestic car and truck sales were 925,437, or 46 per cent improvement.

Jobs at Dodge

A Chrysler Corp. spokesman says manufacture of the Dodge, Valiant and Dart at the old Dodge Main plant in Hamtramck will mean an additional 4000 jobs for the Detroit area. The plant currently employs about 10,000.

Earlier, a union official had suggested that jobs might be scarce at Dodge Main. Chrysler, however, explains there will be more jobs and probably more extra time worked, with both assembly lines held closer to capacity than during the past year.

A fraction of the Dodge production will be at the East Jefferson plant which is mainly a Chrysler-De Soto location.

Chrysler is opening its new St. Louis plant in the fall for 1960 production. No work is expected to be shifted South from Detroit, however.

AVIATION MANUFACTURING

Nuclear Seaplane

The Navy awarded Martin Co. a contract for $127,000 to study airframe designs for a nuclear-powered ASW seaplane.

The design studies will be based on aircraft using turboprop engines, according to W. G. Street, propulsion department manager in Martin's Nuclear Div.

The contract is part of an overall Navy program aimed at putting a nuclear seaplane in the air by 1964.

Street said that Martin will concentrate on a design built around a plane powered by an indirect cycle engine, now under development elsewhere. The Navy favors the indirect cycle engine, Street noted, because it uses a unit shield around the reactor, instead of the divided shield used in the direct air cycle engine.

Inertial Guidance

Minneapolis - Honeywell Regulator Co. has received a $5.4 million contract to produce an inertial guidance system for the Centaur space vehicle.

The contract was awarded by Convair (Astronautics) Div. of General Dynamics Corp., prime contractor on Centaur for the National Aeronautics and Space Administration.

Contract calls for a system capable of placing satellites in precise orbits ranging from 300 to 22,000 miles. M-H officials said the Centaur guidance will be a variation of Honeywell's "mig" (miniature integrating gyro), a pure inertial system.

NEW TERRIER MISSILE STREAKS TOWARD TARGET

An Advanced Terrier guided missile rockets from its launcher in test firing at China Lake, Calif. New weapon will double the performance of present Terrier defense against air attack, says Navy. It is in production at Pomona, Calif., ordnance plant operated for the Navy by Convair (Pomona) Div. of General Dynamics Corp.

Centaur combines a modified Atlas first stage with a Convair-built second stage, powered by liquid hydrogen rocket engines. The engines, under development by Pratt & Whitney, develop a thrust of 30,000 lb in pairs.

NASA plans call for placing a payload of about 9000 lb in a 300-mile orbit, or more than a half-ton in a 22,000 mile orbit or on the moon.

Ride on Flying Saucer

The Saunders-Roe Hovercraft, nearest thing to a flying saucer, made its first flight over water recently. The 7500-lb experimental SR-1 travels over land or water, at a clearance of about one foot, on a cushion of air. This cushion is created by a fast and furious down-draft of air generated inside the vehicle. Forward motion comes from small air jets.

What does it feel like to travel on a flying saucer? A British newspaperman who made the flight describes his sensations.

"We took off or rather we surged upward from the water a few hundred yards out. The 435-hp Leonidas engine was roaring behind the small cabin where we sat, blasting air downwards. We rose a foot or more above the swell. The spray shot up and surrounded us like a cloud. Then the two propulsion ducts came to life, and our view became clear. We were almost at once moving forward at a speed of more than 20 knots.

"This is an experimental machine, not built for passenger comfort. The downward blast lashed the foam into an almost solid curtain of spray. But in the hoverferry of the future passengers will ride in perfectly dry comfort on enclosed decks.

"The sensation of Hovercraft flying is quite unlike normal flying. I can best describe it as a fast ride in a very well sprung luxury car. There is no rolling and far less pitching than there would be on a motor launch moving through water at the same speed.

"We drove straight for the shore for a landing, but there was no change of sensation over land. Only the spray ceased. One moment we were above the water and the next above land. We came to a stop and sat down gently on the shingle."

High-Altitude Vehicle

Ryan Aeronautical Co. was awarded an Air Force contract to study the application of ultra-thin gage, high-strength materials to a high-altitude vehicle.

Ryan said the vehicle would be used to test the functioning of "unique propulsive devices" at extreme altitudes. Details of its configuration were not disclosed.

To carry out the basic design concept Ryan will use its own Miniwate microgage material, a spot-welded combination of corrugated and flat skins of high-temperature alloys.

Meanwhile, Ryan announced it has received a $3.5 million contract to install Doppler navigation equipment in the Army's Mohawk observation plane.

The order follows an earlier letter of intent and assures production of the Model 120A navigation set into spring 1960.

The Model 120A, a small lightweight navigation and flight instrumentation system, computes and displays ground speed and drift angle on an indicator. It also provides electrical outputs of this data for use in other instruments in the aircraft.

NAVY'S NEW CORVUS MISSILE

Drawing shows configuration of Corvus, Navy's new supersonic air-to-surface guided missile. Test version of the Corvus, which is being developed by Temco Aircraft Corp., was successfully air-launched for first time at the Pacific Missile Range, Point Magu, Calif. Corvus is powered by a rocket engine that uses prepackaged liquid fuel.

Nose Cone Locks Self in Stable Flight Position in Flight

The Air Force revealed details on the performance of the Thor nose cone that made the first known fully stabilized space flight.

The nose cone, built by General Electric, automatically locked itself into a completely stable position during the flight through space, the Air Force said.

It did this by taking fixes on the sun and on the earth's horizon, using two infra-red sensors and a sun detector, which cross-correlated stellar and earth-bound coordinate points.

The sensors aligned the vehicle between the two opposite horizons of the earth, 90 deg apart, for stabilization on the pitch and yaw axes. The sun detector, completing the third axis spin, then went into a programmed scan for 15 seconds before locking onto the sun.

Both sensors and the detector fed their data to a computer in the vehicle, which controlled six pneumatic jets to correct the vehicle's course.

The sensors operated on the principle that much infra-red light is radiated from earth, but very little from space. When the sensors picked up a combination of high and low readings, the computer "knew" it was aligned with two horizons of earth. When the readings changed, the computer "knew" there had been a deviation in position and it activated the compressed gas jets to realign the vehicle.

The sun detector eliminated spin by focusing sun rays on special heat-sensitive materials whose electrical resistances change when exposed. When the vehicle started to spin, the detector turned away from the sun, changing the voltages to the computer, which then activated the jet nozzles.

Rocket Test Stand

Aerojet-General Corp. received an Army contract to design a 6-million-lb-thrust rocket test stand for Edwards Air Force Base, Calif.

Initial plans call for a two-position stand to handle two 1.5 million-lb liquid rocket engines. Later the stand will be expanded to a single-position test bay capable of handling four of the giant rockets at a time.

The stand, built on the side of a rocky hill, will be eight stories high and have a 60-sq ft opening for the rocket engines' exhaust. Construction of the test facility is expected to start toward the end of the year.

SUSPENSION *Problem?*

Warming up a "red hot pitcher" and reaching for those wide ones can sure develop "suspension" problems. Something is bound to pop if there is a weak point.

Elimination of weak points which could cause costly failures is a specialty of Burton Spring engineers. The tortuous conditions imposed by heavy loads and high speeds are being met successfully by combining time-tested advantages of steel springs with new developments in their design and engineering. Proper load balance, controlled sidesway and rebound, positive alignment, and structural strength are achieved with today's springs by Burton.

Your suspension problems will find best solution through Burton experience in this specialized field of engineering. Your inquiry is invited.

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Vital Support for the Automotive Industry

WESTERN AVENUE AT FORTY-EIGHTH STREET
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Trucks, buses, trailers, off-highway equipment, and private motor cars of almost every prominent make use Burton Leaf or Coil springs as original equipment.

Circle 137 on Inquiry Card for more data

MEN IN THE NEWS

Continental-Diamond Fibre Corp. — William L. Rodich was appointed president.

Dana Corp.—J. E. Lane was appointed sales manager of the Clutch Div.

Aluminum Co. of America—W. R. Butler has been appointed manager of castings sales.

Weatherhead Co., Fort Wayne Div. — R. C. Marks is now sales manager of automotive original equipment.

Van Norman Industries, Inc. — J. N. F. Reynolds, Jr., was appointed vice-president, manufacturing.

U. S. Industries, Inc., Clearing Div.— D. L. Dumond was named chief engineer and S. Miller sales manager of the Machine Tool Div.

Wagner Electric Corp. — **G. W. Brown** was elected president.

Clark Equipment Co., Brown Trailer Div.—**D. W. Rice** was named manager of the newly formed central sales section.

Dow Chemical Co.—**F. K. Quigley, Jr.,** was promoted to staff manager of coating materials.

Curtiss-Wright Corp., Metal Processing Div.—**P. J. Chaney** has been appointed general sales manager.

Chrysler and Imperial Div., Chrysler Corp.—**W. H. Kough** was made Western Area sales manager.

General Motors Corp.—**W. E. McNaught** is now manager of divisional relations on the Public Relations Staff.

Formsprag Co.—**W. T. Cherry** was made West Coast district manager.

Renault, Inc.—**A. J. Hoffman** was named parts sales manager.

General Motors Corp., Rochester Products Div.—**W. G. Maher** has become director of reliability.

Dayton Industrial Products Co.—**J. A. Conlon** was appointed marketing manager.

Tube Reducing Corp.—**F. P. Huston** has been named assistant chief engineer.

Airborne Instruments Laboratory—**J. F. Linsley** is now manager of industrial sales.

Yale & Towne Mfg. Co., Materials Handling Div.—**J. J. Curry** was named Midwest Regional sales manager.

Ryan Aeronautical Co.—**E. G. Uhl** was made vice-president, technical administration.

Bendix Aviation Corp., Kansas City Div.—**E. E. Evans** was named general manager and **R. J. Quirk** assistant general manager.

Michigan Tool Co., Shear-Speed Chemical Products Div.—**J. W. Decker** has been named sales manager.

Firth Sterling Co.—**Dr. C. H. Toensing** was appointed manager of powder metals research.

B. F. Goodrich Tire Co.—**J. N. Brewster** was named manager of petroleum company sales.

ACF Industries, Inc., Carter Carburetor Div.—**R. F. Ollar** has become government products manager.

American Motors Corp. — **F. F. Kishline,** chief engineer, retired after 45 years in the automobile industry.

Bendix Aviation Corp., Systems Div—**R. J. Sandstrom** was made assistant general manager.

Minneapolis-Moline Co.—**A. E. Smith** was promoted to merchandising manager of the marketing division.

Chevrolet Motor Div., General Motors Corp.—**W. E. Fish** retired as general sales manager and **K. E. Staley** was named to succeed him.

Burdett Mfg. Co.—**L. H. Hill** has been elected president, succeeding **E. B. McCormick,** who was elected chairman of the board.

Necrology

T. A. Parriott, 52, manager of Zerone and Zerex anti-freeze sales for Du Pont Co., died July 29, at Wilmington, Del.

W. A. Kemmel, 60, assistant to the vice-president, trade sales, of Goodyear Tire & Rubber Co., died July 24, at Akron, O.

C. R. Fay, 59, vice-president of the paint division of Pittsburgh Plate Glass Co., died July 19, at Pittsburgh, Pa.

A. H. Odell, 71, retired chief engineer at the power plant of Rochester Products Div., General Motors Corp., died July 15.

E. Loewy, founder and head of Loewy-Hydropress and a vice-president of the parent company, Baldwin-Lima-Hamilton Corp., died July 13, at New York City.

Exclusive design of Sealed Power stainless steel oil rings ends piston groove depth variation problems

Sealed Power 3-piece stainless steel oil rings eliminate groove depth variation problems for two reasons: new end abutment design (see enlargement); and new material (stainless steel).

The cut-away view of the stainless steel oil ring in the piston groove shows how this expander rides independently of the bottom of the groove. The combination of end abutment design—and stainless steel, which has negligible tension loss at engine operating temperatures—means better oil control for the life of the ring. The chrome-plated side rails have the desired initial contact with the cylinder wall—maintain this desired contact where rings with ordinary expanders lose it because of high tension drop-off.

The properly engineered number of spring tension points and sturdy shoulders hold the side rails snugly against the cylinder wall and the sides of the groove. Result? Correct cylinder wall lubrication; no passage of oil around the back of the ring.

OTHER KEY FEATURES:

- Stops oil consumption
- Stops smoking even under high vacuum operation
- Side-sealing
- Quick seating
- Chrome-plated for long life
- Easy to install

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Sealed Power Piston Rings

PISTONS
CYLINDER SLEEVES

Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911
Largest Producers of Sealing Rings for Automatic Transmissions and Power Steering Units

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A Salute to the Oil Industry

an Editorial

THE COVER ILLUSTRATION for this issue vividly portrays the unique research activity which is typical of the relationship of America's great oil industry to its partner in progress, automotive manufacturing industries. The research analyst operating the instrument panel is test driving eight cars at one time at a major oil company research center in Linden, N. J. Results of these studies will be used by every manufacturer in the automotive field.

IN PERSPECTIVE, such modern technical methods seem far removed from the development techniques used during the first 52 years of the oil industry. In the earlier decades after Edwin Laurentian Drake completed the first successful oil well in 1859, kerosene was much more in demand by the public than gasoline. But with the production of popular types of automobiles in 1911, gasoline ceased being a waste product and an economic headache and became a valued commodity eventually sold by more than 181,000 service stations throughout the country. Now the liquid bought for automotive fuel is a complex mixture of chemical compounds, tailor-made for different engines, climates and uses. One company produces some 312 different blends each year. Now even nuclear reactors are being used to process petroleum experimentally.

DURING THE 100 YEARS of progress of America's oil industry, vast economic benefits were created and shared most widely, raising incomes of factory and farm worker alike, increasing the needs and demand for an infinite range of industrial and agricultural products. From a financial standpoint, increases in Governmental income from oil industry and automotive taxes have been fantastically large. During this year which celebrates the 100th anniversary of oil, it is virtually every citizen's duty to do his part to help reduce tax burdens upon both of these vital and productive industries.

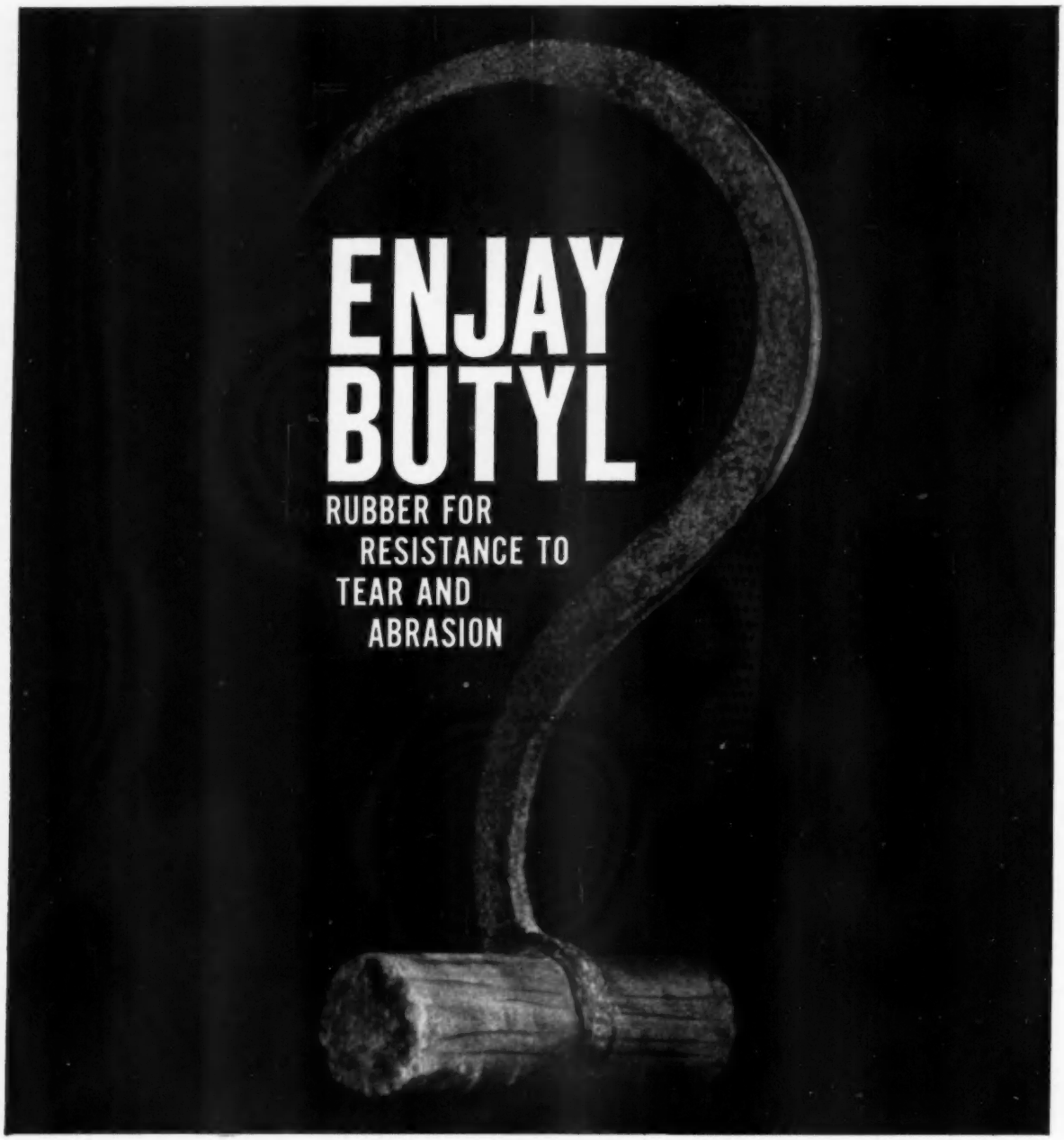
THIS CENTENNIAL ALSO BRINGS INTO FOCUS, the responsibility of individual engineers in the fields of production, design, manufacturing, research and development, to play a more vital role in insuring that the next 100 years will produce an even greater measure of industrial progress than the last. We have no doubt that each technically trained man feels this responsibility. But it is something else again to make sure that each of us does something about this feeling. A first step, which any of us can do and should do, is to participate more actively in telling America about the progress which is being made right now through the joint cooperation of these two industries.

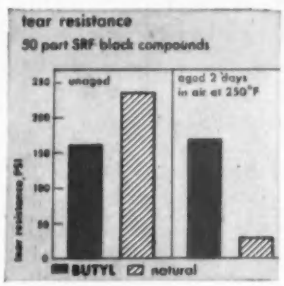
OUR EXAMPLES DO NOT HAVE TO BE BIG spectacular things. A new grease or lubricant which can reduce wear of some automobile parts by more than one-third has just come out of the laboratory stage. This lubricant has proved that it can do the job formerly done by several different greases. In this industry, we are so close to such developments that they seem at times to be taken for granted. But we must all remember that to others, unfamiliar with the constant progress made in these fields, such information is important and significant news. We must communicate more effectively. More engineers and technical men should be spokesmen whose language can be understood by Mr. & Mrs. America.

IN ANOTHER EXAMPLE, WE CAN COMMUNICATE more effectively within the field of engineering. Even in such a field as "cutting oils" it was reported by an internationally known Professor of Engineering, that tests showed that actual "total qualities" of cutting oils could not be successfully specified by any existing table of standard specifications. Some "brand name" oils, not named in the tests, revealed qualities which greatly extended tool life in an unexplained way. Such studies show why the oil and automotive industries continue to provide the kind of scientific dynamics that create greater values, for more people, shared more widely than industry can measure. It is therefore most appropriate to salute the Oil Industry for a job well done. Any guess now would surely under-estimate the advances that oil and automotive manufacturers will bring to America in the next 100 years.

Hartley W Barclay

Editor





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What the ARMY NEEDS in ENGINES

Tactical and Combat Vehicle Engines—the Military Point of View

By Edward F. Blackburne

ENGINEERING DIVISION
RESEARCH & ENGINEERING DIRECTORATE

ORDNANCE TANK AUTOMOTIVE COMMAND
DETROIT ARSENAL

At present Ordnance has three objectives concerning durability and reliability of engines. They are:

1—Increase protection of service vehicle engines to permit full use of the engine's durability potential.

2—Improve service vehicle's reliability by providing superior accessory and subcomponent items.

3—Assure that development vehicles utilize the optimum engines in conjunction with advanced protection techniques and superior ancillary items.

Self-propelled 175 MM Gun T 235, easily maneuverable, lighter in weight, uses 370 hp engine

WHILE the operation of combat vehicles is to some extent more severe than that of tactical vehicles, the co-existence of both types on the battlefield subjects all engines to equal extremes of the military environment. This factor, composed of climate, terrain, driver training and maintenance procedures, seems to control the service life of the engine far more closely than do power

factor or total engine hours.

For the purpose of this discussion, the durability and reliability of tactical (wheeled) and combat (traced) vehicle engines will be treated as a single subject.

This "equality of exposure" combined with a current trend to use similar engines in both kinds of vehicles justifies dealing with all military power plants as an entity.

Reliability vs Durability

Oftentimes these two words are used interchangeably, as though they were synonymous. Nothing could be further from fact. Webster says that reliability means "suitable or fit to be relied on," while durability means "enduring —not wearing out." In the military, a reliable engine is one which starts and operates when it is called upon, regardless of time or place. A durable engine, on the other hand, is one which functions satisfactorily, without major service, for its required service life.

Under the definition of durability the parts of the engine that are of concern include power components and structure. The valves, rings, pistons, connecting rods and crankshaft make up the "power heart." The lives of these components determine the useful life of the engine. Failure in military service means replacement and hence "insufficient durability."

The common types of failures encountered today include:

Hydrostatic lock	**Burnt valves**
Low Compression	**Assembly errors**

Hydrostatic lock, which manifests itself in bent or thrown connecting rods, is caused by accumulation of liquid fuel in the cylinders. Severe cold weather requirements prompt the use of primer systems on most military vehicles. Over-priming by poorly trained drivers led to a rash of hydrostatic lock failures but intense instruction concerning proper starting techniques has reduced primer caused failure to a low level.

Less easy to remedy is the problem posed by the use of electrical "in-tank" fuel pumps. Hot weather vapor lock and slope requirements make the use of such devices mandatory. Pressurized fuel is often driven past the carburetor float valve, either during prolonged engine cranking or when the pumps are inadvertently left running while the engine is stopped. More positive shut-off of the float valve or the use of fuel injection can correct this deficiency but either solution represents a departure from commercial practice and a consequent increase in unit cost.

Low compression in military engines is most often caused by ring wearout. While poor distribution may promote this failure, the common source of difficulty is the entrance of dirt and dust through the induction and breather systems. The standard military oil bath air cleaner is 98% efficient. A combat vehicle engine so equipped can be expected to achieve a service life of 2000 miles under conditions of extreme dust. Even high quality chrome rings with which the engines are fitted cannot withstand more than this. During the 2000 miles the engine will have ingested some ten pounds of fine dirt if the induction system is kept intact. Loose clamps, perforated hoses and general induction system deterioration contribute to much earlier engine demise.

When Ordnance became aware of the limitations of the standard systems it embarked, together with industry, upon a campaign for improved engine protection. Since, in air cleaner work, we are more concerned with the dirt passed than the dirt retained work was begun upon dry type air cleaners of efficiencies greater than 99%. More to the point, military engines will have to swallow less than 1% of total dust taken into the induction system. This compares with the 2% now accepted. From this single change it is hoped to double the durability of engines in dusty operation.

The air cleaner sets the standard of engine protection. Whether or not this standard can be met is determined by the quality of other components of the induction system. More stringent specifications for hoses and clamps are being written. Scrupulous attention to the details of breather systems is being paid during the early stages of vehicle design.

While dust conditions are usually associated with desert operation, experience shows that the problem is world-wide and independent of temperature and terrain. All vehicles, tactical and combat, must be adequately protected.

HOW INDUSTRY CAN HELP

To achieve present objectives, Ordnance must have the help of industry. Some of the ways in which assistance can be rendered are:

1—By seeking to understand the nature of the military environment and by recommending components suited therefore;

2—By making early release of development information so that military vehicle planning can incorporate components of the proper time frame;

3—By assisting the military in the collection of field data. Protection and improvement of components is a joint military-producer responsibility.

4—By cooperating with the military in installation as well as selection of components;

5—By offering assistance of any problems relating to the operation of military engines, whether or not they are directly related to the engine.

Maximum engine reliability is required in this new mechanical ditch - digger which digs a fox hole in one or two minutes; excavates to a depth of six feet

Burnt valves, which contribute to low compression failures, are cited for special attention because they exemplify the effects of poor maintenance. While maladjustment of fuel or ignition systems (in themselves maintenance failings) can cause valve burning, the most common cause is engine overheat due to clogged cooling systems. Unless a major engineering effort can uncover a self-cleaning cooling mechanism, service training must be relied upon as the only solution to the valve burning problem.

The final major type of durability failure encountered by the military may be generally categorized as the "assembly error." This encompasses the mis-assembly of components, the maladjustment of vital operating parts and inadequate break-in. All are incipient failures built in at the factory. In commercial practice all or almost all can be detected by a strong dealer organization during a specified user break-in period. The Ordnance Corps and the combat forces have neither the trained manpower nor the time to duplicate the civilian situation. Military equipment, when delivered, is expected to run without restriction. It must be ready to carry its burden whether the odometer reads one mile or ten thousand.

This requirement may seem unrealistic during peacetime. One need only reflect upon the demands of war to realize that successful "factory to fighting front" delivery, a luxury today, could be a necessity tomorrow.

The four failure types discussed represent the majority of durability deficiencies found in military ground vehicle power plant service. None are directly attributable to the engineering of the power plant itself. The military environment coupled with inadequate protection contributes a major share. Inadequate quality control makes a bad situation worse. Nevertheless, Ordnance experience shows that engines, of commercial or military design, do possess the inherent durability required. It is incumbent upon both Ordnance and industry to provide the ancillary equipment and techniques needed by these engines to develop their full durability potential.

Reliability

Military vehicle engines are unreliable. This conclusion is borne out every day in military operations throughout the world. Military engines are unreliable because of the failure of low cost items upon which expensive power plants must rely. Spark plugs, spark plug leads, generators, fuel pumps, fuel lines, carburetors, seals, sending units and exhaust manifolds are never-ending sources of trouble. Some people say that our difficulties lie with our drivers and our maintenance procedures. We might be inclined to believe this were it not for the well publicized difficulties experienced by civilian vehicle operators. Their trouble areas are remarkably similar to our own.

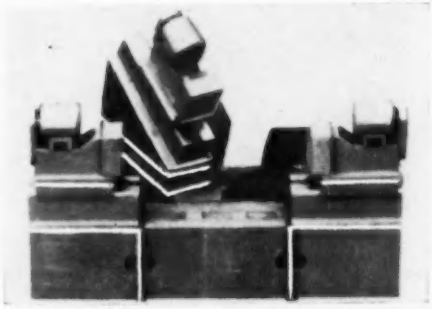
Unlike most civilian operators, the military cannot depend upon well equipped garages and well trained mechanics for speedy repair of deadlined equipment. Systems analysis equipment is extremely rare in forward areas; we must rely upon man's intelligence and a small assortment of wrenches. Support of airborne operations, for instance, calls for paradrop or helicopter delivery of maintenance personnel and equipment. Under these circumstances availability of diagnostic equipment is nil and even unit replacement is difficult to support.

What, then, is the answer? It seems to us that the solution lies in a concerted effort on the part of accessory manufacturers to bring the level of sub-component durability into line with that of the basic engine. In a military sense

(*Turn to page* 107, *please*)

"Building-Block" Standards for High Production MACHINE TOOLS

Fig. 1—Typical arrangements



SINGLE STATION MACHINE

Problems of Increasing Useful Life and Reducing Obsolescence Cost of High-Production Machine Tools Solved, at Least Partially, by Agreement on a Limited Series of Standard Specifications

AGREEMENT on a "limited" series of standard specifications for high-production machine tools has been reached, according to Henry C. Daum, manager of Ford Motor Company's machining process department and chairman of an industry study committee.

It follows negotiations during the past four years among various user groups and machine tool builders in a concerted effort to formulate building-block or unitized-design standards as a means of reducing obsolescence of expensive special-purpose equipment.

Machine categories are single-station (one way, two way, three way, four way, and more than four way), and multiple-station (transfer, dial, trunnion, center column, and shuttle).

Dimensional requirements have been set out in detail in a 14-page "Manufacturing Standards" for "Production Machine Tools." A uniform work loading height of 42 in. has been established for all single-station and multiple-station machines, trunnion type excepted.

In announcing the new standards, Mr. Daum emphasized that only a limited number of specifications have been included, and that there is no intention to dictate design features to machine tool builders. It is expected, however, that they will, to a large extent, enable future replacement of one or more sections of a production line with other standard sections and thus adapt the basic line to production of newly - designed parts.

The industry - wide building-block concept was initiated by Ford Motor Co., General Motors Corp., Chrysler Corp., and International Harvester beginning in 1955.

"Until recently," Mr. Daum said, "it appeared that automation with its enormous investment in equipment might tend to freeze design in the automobile industry. The large transfer machines in use, particularly those for machining large components, have been highly specialized and difficult to adapt to changes in model and part design.

"The building-block or unitized-automation should encourage incorporation of technological advancements and product design changes which benefit the buying public, since the flexibility of equipment will make the changes less costly."

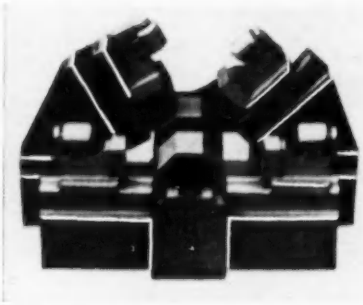
Mr. Daum added, "The building-block concept also appears to be the answer to extending the automatic production line into new areas of industrial use, since purchase of the new equipment will be more economically practical for smaller companies."

Specifications apply only to the mounting and attaching surfaces of main bases, wing bases, feed units, horizontal angular adapters, angular columns, and the bolting patterns thereof; the uniform work loading height and the application of specific components utilized in the construction of production machine tools. Arrangements are shown in Fig. 1. Typical dimensions not shown in the complete specifications, method of actuation and the type and utilization of mechanical, hydraulic and electrical controls shall be to the manufacturer's standards unless otherwise specified by the procuring activity.

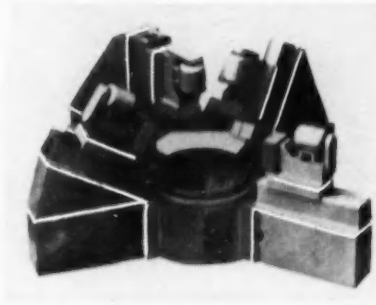
Figure 2 illustrates the mounting and attaching surfaces of vertical columns to which the specifications apply. These areas are indicated in the caption.

Following are condensed specifications, some of the areas to which they apply being shown in Fig. 3.

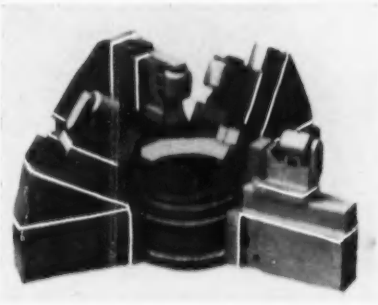
of components and units of production machine tools. White lines indicate areas of standardization.



TRANSFER AND SHUTTLE MACHINE



DIAL TYPE MACHINE WITH INTEGRAL WING BASE ATTACHING PADS



DIAL TYPE MACHINE WITH "T" SLOT AROUND PERIPHERY OF BASE

CONDENSED SPECIFICATIONS

Work Loading Height — A 42 inch work loading height shall be uniform on all production machines. The 42 inch height specified, is measured from the bottom of the main base to the loading surface of the piece part.

Main Base—Main bases for one and two-way type machines shall be provided with two attaching surfaces, one on each end, to facilitate the conversion of a single-end machine into a double-end machine. The bolt hole pattern and machined surfaces shall be as specified where applicable.

Main bases for multiple-way and trunnion type machines shall have wing base attaching surfaces as specified.

Two-station main bases for transfer and shuttle machines, shall be provided with four component attaching surfaces, one on each side of each station. The single station main base shall be provided with two attaching surfaces, one on each side. The bolt hole pattern and machined surfaces shall be as specified. Length and width of fixture mounting surfaces to be as required.

Main Base (Dial Type & Center Column Machines) Not Shown—Main bases for dial type and center column machines, having "T" slots around the periphery, shall be machined to receive a one inch diameter bolt to be to the current American Standard (A.S.A.). "T" slot location, to be the manufacturer's option, to coincide with applicable wing base adapter.

Main bases for dial type and center column machines that have integral pads for attaching wing bases, shall be provided with the fitted key location method specified. The bolt hole pattern shall coincide with the applicable wing base.

Wing Base—Wing bases to be provided in five sizes, in relation to the specified feed unit size. The main base attaching surface shall be to requirements specified. The method of locating the wing base to the main base shall be as specified.

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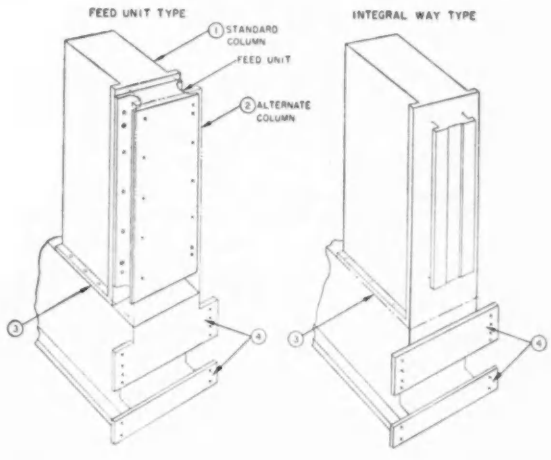


Fig. 2—Standardized areas of vertical columns. (1) Feed unit and column mounted on wing base in position, receded from attaching surface. (2) Alternate column mounted on wing base in position, flush to attaching surface. (3) Feed unit mounting surfaces. (4) Wing base attaching surfaces.

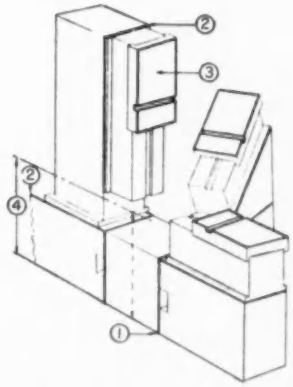
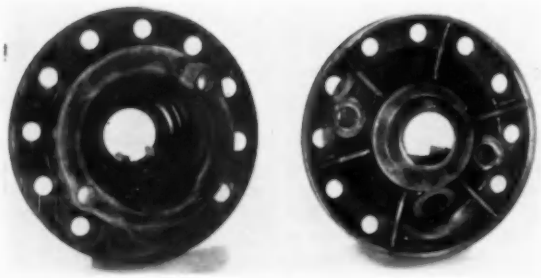


Fig. 3—General specifications of production machine tools. Bold lines indicate areas of standardization. (1) Wing base attaching surface. (2) Feed unit mounting surfaces. (3) Saddle mounting surface. (4) Work loading height.

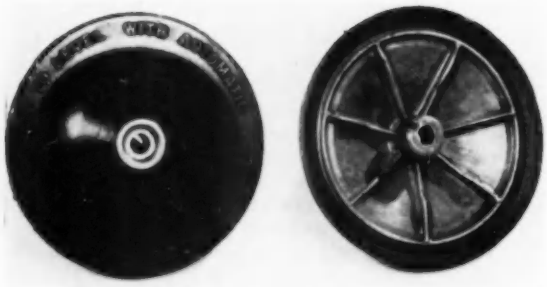
Unprotected Magnesium Performs Well in Automotive Parts

Magnesium fuel pump air body after 11 months of service. Since fuel pumps are located out of the direct wheel splash area, corrosion-inhibiting oil film formed on the part is not disturbed.

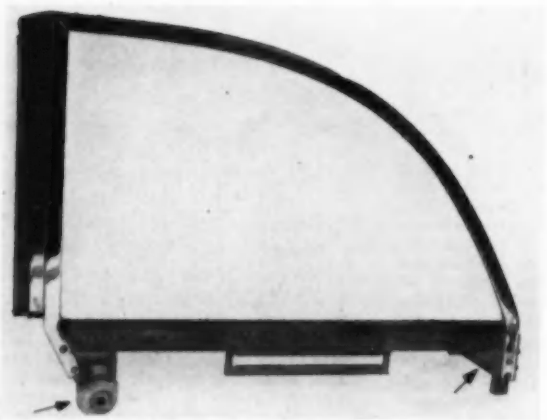
By H. A. Schertel
Automotive Development Engineer
THE DOW CHEMICAL CO.



Magnesium oil filter bypass valve body (1957 model car, 36,000 miles) shows oil discoloration but no corrosion. Part was put in service as-cast with no protective finish.



Magnesium power steering oil reservoir cover of 1955 model car, photographed after 31,500 miles. Part has paint finish applied to entire assembly. Most of assembly is steel, requiring paint for protection. No paint would be required if assembly were all-magnesium.



Window bracket assembly is not in oily environment. Hence magnesium parts (arrows) show slight corrosion attack but no more than bulk of assembly, which is steel. This assembly was in service six years. The magnesium parts were used in the as-cast condition with no protective finish.

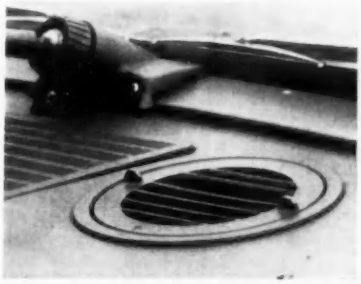
SERVICE experience with magnesium automotive parts has demonstrated that this metal can be used for a broad range of applications under the hood and in the transmission area without protective finishes. A detailed article on present and potential applications of magnesium in a passenger car was published in the May 1, 1958, issue of AI.

Designers unfamiliar with magnesium have commonly supposed that the finishing systems used on the metal in missiles and aircraft would be required in the automotive field. In actual service, however, magnesium automotive parts, either bare or finished with a simple chrome pickle dip, have performed adequately. As with other automotive metals in similar applications, the normal corrosion encountered is not sufficient to interfere with the proper functioning of the parts involved.

The fact that the working parts of an automobile are located in an oily environment is basic to this good performance. The thin oil film formed on parts serves as an excellent corrosion inhibitor. This oil film is disturbed only if the part is in the line of *direct wheel* splash. Note the emphasis on *direct wheel*.

One of the major U. S. automobile manufacturers has used magnesium successfully in torque converter and clutch housings. Although these parts were in a splash area, it was not an area receiving direct wheel splash. The protective oil film was not disturbed and the parts, therefore, met service requirements. No attempt was made to insulate possible galvanic action between magnesium and dis-

(Above)—Magnesium steering column bracket and clock bezel (1957 model car, 41,000 miles). Bracket shows scratches and other effects of normal wear and tear but is not corroded. (Right)—Clock bezel likewise shows no corrosion. These parts use the same paint system as the metal magnesium replaced.



Magnesium defroster vents (1957 model car, 32,000 miles) are finished with standard automotive paints.

similar metals. Where such insulation appears advisable, economical gasketing materials already used by the automobile industry will do the job.

Salt-spray tests (10-20% NaCl) are comparative only and do not indicate what the corrosion resistance of magnesium automotive parts (or parts in any other metal) will be *in service*. Such tests usually are more severe than service conditions and do not take into account the added protection of accumulated oil film.

The Dow Chemical Co. knows of 22 engine, transmission and running gear parts in which magnesium has been used successfully.*

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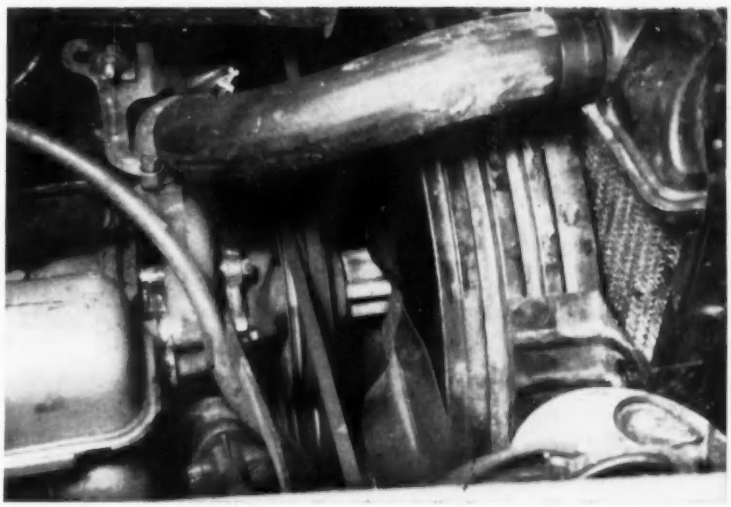
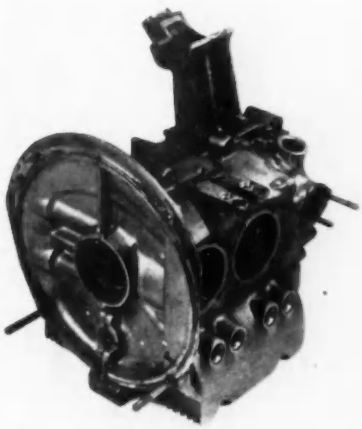
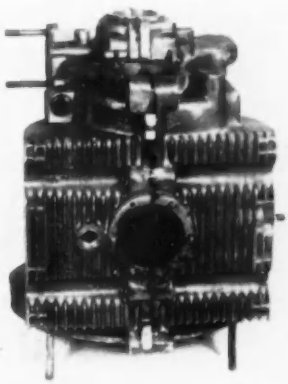


Magnesium fan spacer (1957 model car, 17,000 miles) is but slightly discolored. Fan spacer is in a relatively high and dry area, is subject only to intermittent wetting. One major automobile manufacturer has used magnesium fan spacers for the past nine years.





Two views of Volkswagen crankcase, photographed after 60,000 miles of service during all seasons of year in central Michigan. Simple chrome pickle was only finish applied. Oil film contributed to excellent condition of these parts, which are subject to road splash.

* Crankcase, transmission housing, clutch housing, torque converter housing, oil pump housing, oil filter base, oil filter bypass valve body, fuel pump air body, fuel pump cover, fuel pump diaphragm support, fuel pump combination body, main bearing oil seal, transmission shift rail guide, transmission stator blade, transmission support bracket, engine fan, fan spacer, camshaft timing gear, power steering oil reservoir cover, generator end plates, starter end plates, internal parts.

V-6 and V-12 Engines for New GMC Trucks

As an introduction to an outstanding line of motor trucks to be announced in the indefinite future, GMC Truck & Coach Div., has revealed the details of a family of engines now in the process of testing in the laboratories and on the road. We refer to the new family of 60 deg V-6 and V-12 (twin-six) gasoline engines. So far as can be determined engines of such configuration constitute a first in the USA, for truck purposes, and may be a first anywhere. All of these engines will have moderate compression ratio and will operate on regular gasoline.

At the outset the new family will consist of three V-6's and one V-12. Stroke for all engines is the same—3.58 in., making connecting rods and bearings fully interchangeable. The 305 V-6 engine has a bore of 4.25 in.; the 351 V-6 has a bore of 4.56 in.; the 401 V-6 has a bore of 4.88 in.; while the 702 V-12 has a bore of 4.56 in., same as for the 351 V-6.

At the time this article was prepared some of the major items of engine specifications were not available. For example, compression ratio was not yet established for the Series 305 engine; while on the other engines it was anticipated that compression ratios would range somewhere between 7.5 and 7.75 to 1.

Similarly neither maximum horsepower ratings nor torque were available in final form. The best we can say at this writing is that on Series 305 maximum bhp may lie in the range of 150 to 165 at speeds ranging from 3600 to 3800 rpm. Torque is expected to be between 260 and 270 lb ft at 1600 rpm.

On the Series 351 maximum bhp should come out around 180 at 3400 rpm; while torque may be around 312 lb ft at 2000 rpm.

On Series 401 maximum bhp is anticipated around 205 at 3200 rpm while torque should be in the range of 377 lb ft at 1400 rpm.

On Series 702 maximum bhp should be around 275 at 2400; while torque will be around 630 lb ft at 1300 rpm. In all cases the final speed established for maximum horsepower is governed speed.

The transverse cross-section, Fig. 1, indicates the general arrangement of components and accessories as well as the special geometry of the combustion chamber. It will be noted that most of the chamber is defined by the trapezoidally-shaped cavity in the head with a shallow, circular cavity in the piston head. This geometry is seen in larger scale in Fig. 2.

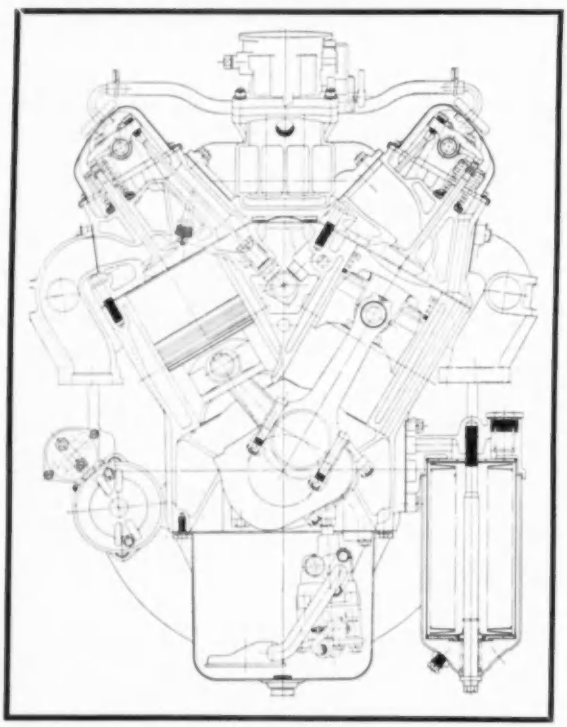


Fig. 1—Typical transverse cross-section of new 60-degree V-type engines showing functional details as well as disposition of accessories. Note valve train layout as well as large cored hole in head to permit removal of valve lifters with a special tool. Spark plugs are on the inside of the bank away from exhaust heat and readily accessible.

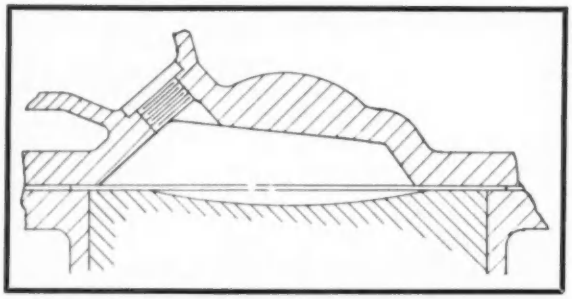


Fig. 2—Cross section through the combustion chamber to show the nature of its geometry. Most of the compression volume is contained in the head cavity with only a shallow, circular cavity in the piston head. Spark plug location is to the inside and at the high side of the cavity.

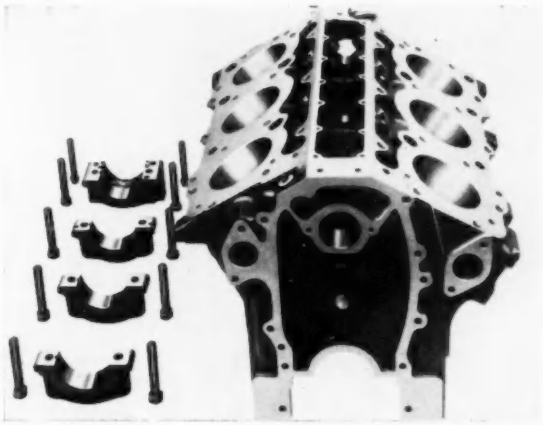


Fig. 3—Frontal perspective of a cylinder block shows the massive construction and deep drop skirt. At the side are the main bearing caps and fastenings which are fully interchangeable on all engines.

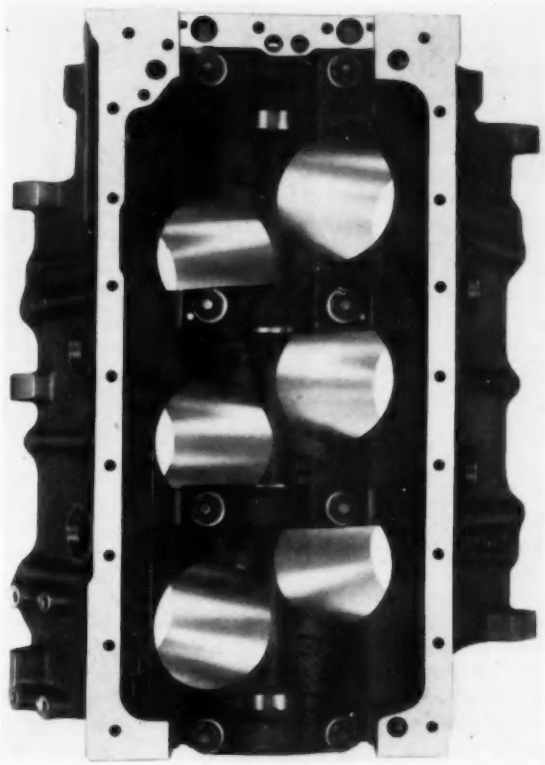


Fig. 4—This bottom view of a cylinder block shows the large cylinder bores. Note the offset arrangement of engine banks.

Cylinder blocks all are of fine-grain nickel-chromium alloy cast iron with deep 3-in. drop skirts for added strength. Cylinder heads are cast of the same material. It may be noted that only two different heads are required for the entire family. One type is used on the Series 305; the other takes care of the rest. Two heads are used on the V-6's, four heads on the V-12, to provide for full interchangeability.

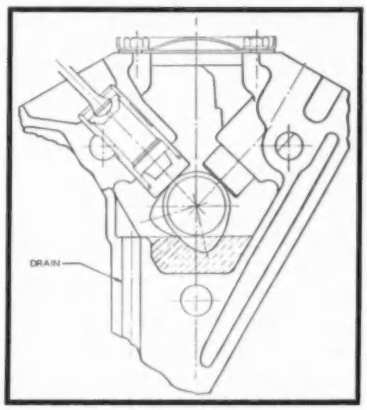
Figure 3 shows the deep, rigid construction of the block, and indicates that main bearing caps and their fastenings are interchangeable on all engines. A still better impression of the ruggedness of cylinder block design is found in Fig. 4. In addition to defining the massive, ribbed main bearing decks, it also shows the degree of offset of engine banks.

The crankshaft setup is quite interesting primarily because the shaft for the Series 305 is of cast ArmaSteel, whereas on the remaining engines the crankshafts are drop-forged, using a chromium-alloy steel with Tocco-hardened journals. To emphasize the strength of these shafts, it is of interest that the weight of the shaft for the Series 401 V-6 is about 110 lb.

V-6 crankshafts have four main bearings and six individual crank pins, evenly spaced at 60-deg intervals. The V-12 has seven main bearings and six, double crank pins spaced at 120-deg intervals. Journal fillets are ground and polished by a new machining method in an uninterrupted contour free from stress concentrations. Connecting rods are of I-beam section, drop-forged and heat-treated.

Combustion chambers, mentioned earlier, are fully machined and are designed to assure rapid burning of the fuel-air charge during the early part of the stroke. Their geometry also features increased turbulences, freer breathing, closer regulation of compression ratio, and smoother operation. Short, individual intake and exhaust ports contribute to high volumetric efficiency and rapid discharge of exhaust gases. Exhaust ports are located on the outside of the heads to minimize heat rejection to the engine and to prevent localized hot spots.

Fig. 5—Ingenious arrangement for lubricating the valve lifter face is found in the cored pocket directly under the cams. When the engine is stopped oil drains down to fill the cavity into which the cam lobe dips. Once the engine is started, most of the oil is removed by splash.



As seen in Fig. 1 the spark plugs are located on the inside of the V, on the high side of the combustion chamber and are readily accessible. Valve tappets are designed for removal through an opening in the cylinder head without removing the head. Another important design detail is that valve guides are drilled directly in the head metal.

For maximum efficiency and faster warm-up, the intake manifold is preheated by exhaust gases pulsating from one head to another through a passage cast in the bottom of the intake manifold.

On V-6's the carburetor and in-

take manifold are centrally located between the cylinder banks; while the V-12 has dual carburetors and intake manifolds, each serving six cylinders, mounted in the same relative position. The fuel pump is conveniently located at the top right of the engine front cover. Starting motor, oil filler cap, oil dip stick, air compressor for air brake models, and the generator all are on the right side of the engine. Distributor and coil are at the top rear between cylinder banks for accessibility.

Pistons are heavy-duty, permanent-mold aluminum castings with a steel expansion control band cast integrally. Pistons are cam-ground and tin-plated. All except the Series 305 have a steel top piston ring groove insert to reduce ring wear, eliminate pounding of the groove, reduce ring sticking, and provide for better sealing. Three concentric compression rings and one oil control ring are fitted above the floating piston pin.

Except for one version of the Series 305 engine, both intake and exhaust valves are fitted with positive valve rotators to extend valve life. Exhaust valves for the Series 351, 401, and 702, moreover, are sodium-cooled and hardfaced, and have replaceable valve inserts.

Mechanical valve lifters are provided on the V-6's; while the V-12 due to its lower governed speed employs hydraulic valve lifters. Valve lifters in all engines are constantly rotated due to a slight turning moment created by the offset location with respect to camshaft lobes. This rotation assures longer lifter wear by distributing load applications over the flat, hardened lifter foot surface. Scuffing is controlled in two ways: by imparting a Parker-Lubrite coating on both the cam and lifter foot surfaces; and by an ingenious device seen in Fig. 5. It will be noted that a depression is provided in the cylinder block casting under each of the cam lobes. When the engine is stopped, lubricant drains down to fill the cavity. When the engine is started, all of the cam surfaces are automatically lubricated before they feel the effect of the normal pressure lubrication.

All engines employ a more efficient rotor-type oil pump which supplies oil at the rate of 14-gpm on V-6's, 17-gpm on the V-12, at 60-psi. These pumps assure lubrication even at idling speeds. A full-flow oil filter with a paper-type throw-away element is supplied on all engines. A by-pass valve is provided to assure continual flow even if the filter becomes clogged.

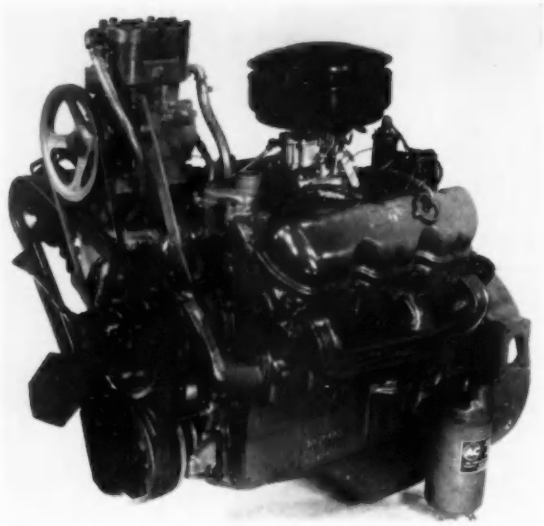


Fig. 6 — Three-quarter view of a Series 401-V-6, showing arrangement of accessories, mounting and drive for the air compresssor, carburetor mounting, and detail of the ribbed exhaust manifold casting.

GMC has made special provisions for governor control of engine speed. Velocity-type governors are available as optional equipment on the Series 305; but are standard on the Series 351. On the Series 401 and 702, on the other hand, a hydraulic governor, designed and built by GMC is provided as standard equipment. It consists of two units: an oil pressure controlled diaphragm in the carburetor assembly for operating the throttle plates; and a spinner valve located in the bottom of the oil pump for controlling oil pressure to the diaphragm. An oil line running through the cylinder block connects the two elements.

In operation, oil pressure from the oil pump passes through the spinner valve which is arranged to open only at a predetermined engine speed, then the oil pressure is transmitted to the diaphragm. Below governed speeds the spinner valve remains closed, with a consequently reduced pressure in the line, to assure instant response. A special feature is incorporated in the spinner valve to take care of variations in oil viscosity. This is accomplished by means of the spinner valve control spring which is adjustable by turning the spring nut. Once an initial adjustment is made no further changes are required for the life of the engine. This also prevents fooling with governor adjustment since it is buried in the crankcase.

For more specific detail on carburetors, it may be noted that a single-barrel carburetor with manual choke is supplied on the Series 304 A and B engines. A two-barrel, 1¼-in. carburetor with manual choke is used on the Series 305C and 351. The Series 401 has a 1½-in. two-barrel carburetor with manual choke. Two of the same carburetors are employed on the Series 702 engine. They are interconnected by a simple straight rod, the carburetors being synchronized so that throttle openings match.

Special attention has been devoted to cooling fluid flow to assure adequate cooling of spark plugs and valves as well as cylinder block and heads. Water is pumped directly to the front of the block, through the entire block around the bores, then through transfer holes at the rear to the cylinder heads. After passing completely through the heads the cooling fluid returns to the pump and radiator. The main objective has been to assure proper velocity of the fluid at any point in the head. Important feature of the cooling system is the large,

Fig. 7—This view of the Series 702 V-12 engine provides an impression of the low and narrow profile of this big engine. It shows the method of installing the two, two-barrel carburetors.

permanent by-pass from the water outlet manifold to the pump inlet cavity. The water pump is always supercharged because water enters the pump under pressure. A single thermostat is used in the Series 305A engine; two in the 305B and C, 351 and 401; while three thermostats are fitted on the Series 702.

Crankcase ventilation is another important detail. While road draft is sufficient on the Series 305A engine, all other engines employ positive ventilation. Here manifold vacuum draws fresh air through a replaceable paper element breather at the left rear of the block. Air enters the crankcase, passes through it and up through the front cover. The system employs a unique cap in the head cover to which the hose for the intake manifold is connected. It is provided with a tubular fitting for the hose, making it possible to remove the cylinder head without interfering with the ventilating system, also permitting the use of a common cylinder head cover for all engines.

From the standpoint of performance in a motor truck, it is important that maximum torque is developed at moderate engine speed. On the Series 401, for example, maximum torque is developed at around 1400 rpm. The Series 702 engine, with its big displacement, has been designed to operate at a relatively low specific horsepower output but with extremely high torque at low speeds. Thus it operates at less than full power output at all times and under normal conditions runs at low throttle opening, which is an important factor in improving valve life.

Consequently, the 702 engine should have great durability with silent and economical operation, since it never runs at full capacity. Noteworthy advantage of the large engine is that its reserve power permits the use of a five-speed transmission with a single-speed axle as contrasted with the usual requirement of 8- or 10-speed transmissions. The reserve power built into the 702 engine is expected to permit large highway tractor-trailer combination to take uphill grades at good speeds with a minimum of downshifting.

Mention was made earlier of

(*Turn to page* 107, *please*)

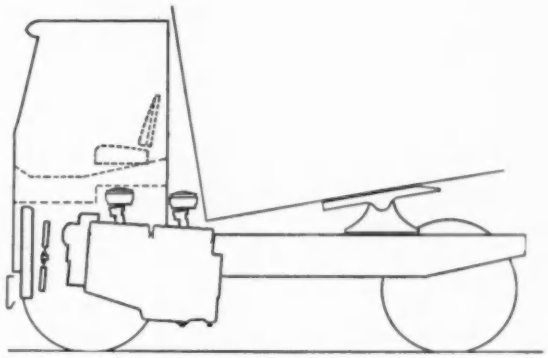


Fig. 8—The sketch shown here suggests the method of installing the V-12 engine in a heavy duty tractor. The engine is long enough so it will extend beyond the cab line in the rear. However, it can be mounted low enough to provide ample clearance for the front end of the trailer.

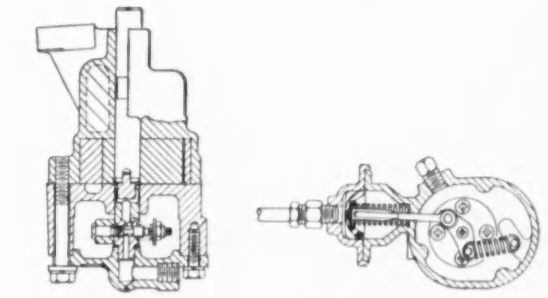


Fig. 9—The drawing (near right) shows a section through the oil pump to indicate the arrangement of the spinner valve for the hydraulic governor. The valve functions as a flyball under centrifugal force, this force being counteracted by the spring on the same axis. Oil from the pump is fed through a hole in the center of the spinner shaft. When governed speed has been reached, a groove in the valve is aligned with this hole to permit oil under pressure to flow to the diaphragm (shown far right), the latter being mounted directly to the carburetor body.

Major Gains Seen In Marine Inboard Engine Field

Further Increases Expected In 1960

MAJOR advances in both design and production of typical inboard marine engines were reported by five manufacturers who disclosed details of their 1959 trends in special reports for AI. The consensus was that major further design and production advances would be made by these companies in 1960, with engine features substantially influenced by greatly increased overall demand for higher horsepower, more compactness, speed, durability and economy. Nineteen fifty-nine production is up more than 30 per cent for the average of the five companies. While modernization programs are continuously advanced in production equipment, total facilities are expected to be adequate for accommodating an equal increase in production in 1960. The increased demand for inboard engines is a natural evolutionary result of the continued large scale expansion in use of outboard engines, it was pointed out. Several new models will be announced this fall.

While current industry-wide production and sales data for all inboard marine engine manufacturers is not available from any technical statistical service, a reliable indicator of the strong upward trends of total marine craft production is the accompanying chart of the index of shipments of recreational craft compiled by the National Association of Engine and Boat Manufacturers. Through May 1959, this index reached a peak of 2220 compared with 1620 in April 1958 and 720 in April 1955. The monthly average of shipments of recreational craft more than tripled during the period from 1954 through 1958, with a substantial further rise to an index of 1667 for the five month average of 1959.

Product Designs Influenced

The boom in demand has definitely influenced product design, typical inboard engine manufacturers pointed out. R. H. Mitten, vice-president of Gray Marine Motor Co., said that his company has observed a continued public insistence upon more power. "A famous stock boat builder," he continued, "who is one of our biggest customers, originally produced an 18-ft utility in which our 91 cu in. 25 hp engine was standard. They are now delivering the current version of this excellent boat with a 60 hp Graymarine engine and a popular modified version with our 70 hp and 109 hp models. People want to go faster. This accounts in part for the popularity of the new V-8's. These high output engines have higher compression ratios and require premium fuel, but they drive boats faster. Cruiser speeds today are the runabout speeds of 15 years ago and runabout speeds approach the hydroplane speeds of the old 225 cu in. racing class."

R. C. Bolling, president, The Palmer Engine Co., reported that "the demand for a light, powerful V-8 engine has dictated a swing in this direction and we have been very pleased to answer this demand

Estimated Sales of Outboard Motors, and Number in Use, by Years

Compiled jointly by National Association of Engine & Boat Mfrs. and Outboard Boating Club of America

Year	Unit Sales	% of Sales by Hp. 0.0-6.9	7.0-14.9	15.0 & over	Avg. Hp. Units Sold	Outboard Motors in Use	Outboard Boat Sales	Boat Trailer Sales
1947	584,000	87%	11%	2%	4.7	1,857,000	143,000	3,780
1948	490,000	81%	16%	3%	5.2	2,321,000	198,000	5,700
1949	329,000	67%	28%	5%	6.4	2,643,000	171,000	8,285
1950	367,000	61%	30%	9%	6.9	2,811,000	131,000	18,390
1951	284,000	47%	37%	16%	8.9	3,010,000	154,000	20,360
1952	337,000	52%	33%	15%	8.4	3,219,000	164,000	39,220
1953	463,000	46%	33%	21%	9.0	3,419,000	231,000	72,000
1954	479,000	42%	34%	24%	10.3	3,740,000	223,000	103,000
1955	515,000	31%	32%	37%	12.9	4,210,000	258,000	129,000
1956	642,000	27%	35%	38%	14.2	4,740,000	302,000	151,000
1957	550,000	22%	27%	51%	16.3	5,140,000	320,000	165,000
1958*	545,000	17%	25%	58%	20.7	5,525,000	316,000	166,000

* Preliminary estimates.

Inboard engine makers reported that increased sales of outboard motors eventually push up sales of inboard engine equipped craft.

HORSEPOWER UP—WEIGHT and DISPLACEMENT DOWN

In-board Marine Engine Specification Trends

14-year period, 1945-59 inclusive

Average horsepower, displacement and weight of marine engine models offered by Chrysler, Chris-Craft, Gray Marine, Lathrop, Norseman (Nordberg), Red Wing (Thorobred) and Universal.

Years	No. of Models	Horsepower (With Std. Acc.)	Displacement	Weight
1945	79	80	351.9	1,014
1950	92	89	335.6	961
1955	88	99	276.3	831
1959	69	114	239.4	733
Net Change 1945-'59	−10	up 34	down 112.5	down 281

Summary: Fourteen year trends show an aveage increase in horsepower of 42%, a decrease in displacement of 32% and about 28% average weight reduction. The trend is definitely toward lighter, more compact and more powerful inboard marine engines.

with such an engine based upon a newly introduced International Harvester light truck V-8, turning 4000 rpm and developing better than 200 hp with an overall weight of approximately 900 lb and having outward dimensions almost exactly similar to the best known three small V-8 marine engines in the field. We have also taken notice of the increasing light Diesel engine market and have made arrangements with the International Harvester Co. to marine all of their light Diesel engines, just as we now do with their gasoline line.

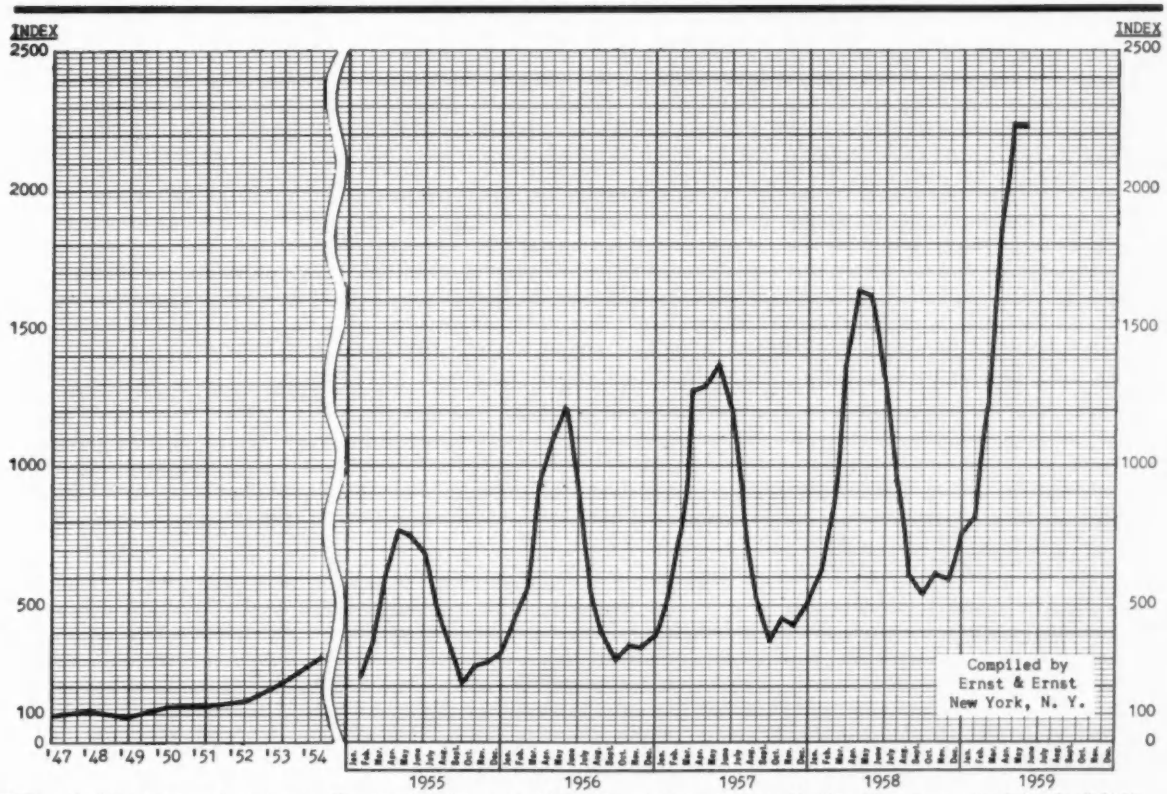
"As boats go faster and faster," he continued, "marine engine manufacturers necessarily must produce more and more power while continually striving to decrease weight and bulk. We are going more into the use of aluminum casting design, for this purpose."

C. V. High, assistant advertising director of Chris-Craft Corp., further confirmed the impact of demand upon engine design. He said that the trend is "definitely away from the L-head six to the V-8 and also to higher shaft horsepower.

(*Continued on next page*)

INDEX TRENDS—SHIPMENTS OF RECREATIONAL CRAFT

(National Association of Engine and Boat Manufacturers, Inc.)



NOTE: Indices are based on Average Monthly Net Shipments 1947-1949 = 100.0. Average Monthly Figures are used for 1947-1954.

Our present development (Chris-Craft) is toward engine accessories, improved efficiency, increasingly more compact designs and fresh water cooling systems, etc." Explaining these trends, he added, "People are stepping up from the outboard to the inboard power boats and as the market increases for one, the other follows. Engine room space problems foster a continual need for ever smaller, more compact, efficient marine units."

Designs Standardized

The influence of modern production methods upon manufacturing trends has been a factor in creating the strong up-trend in this field, it was emphasized by R. H. Mitten, vice-president of Gray Marine Motor Co. He said, "A factor that should not be ignored is that the market itself has changed and procedures which were necessary 10 or 15 years ago are no longer effective today. Marine engines used to be sold and shipped one or two at a time and the boats were custom built in small yards. The engine manufacturers all published elaborate catalogues with detailed specifications, which the customer studied, and the choice of a correct engine to fit the boat design the customer had selected rested between the engine manufacturer, the boat builder and the owner. Contrast this with the situation today when boats are relatively cheaper because they are built on production lines, to standardized designs, by stock boat builders and in high volume. A further factor is that today's big volume of boat production has attracted new money and high grade management."

INBOARD MARINE POWER PLANT TRENDS DATA

Trend Indicators	Chrysler Marine	Palmer Engines	Gray Marine	Chris Craft	Marine Eng's, Inc.
Production-Order Trend 1959 vs. 1958	Up 100% on orders	Up 20% on production	Up 20% on production and shipments	Up 15-20% on production	Up 15% on sales
Production Facilities Trends	Modernized early in 1959	Modernized shop and facilities	Ample shop facilities	Added new machinery	Facilities adequate
Influence of Demand on Product Design	New V-8 now on market	New light V-8 and new light diesels	New V-8's	Trend to V-8's is strong	New model V-8's

Production Equipment Modernized

While production capacity has not been sharply expanded by the manufacturers who reported on their production status at mid-year 1959, some of the firms pointed out that they continuously make routine replacements of machine tools. The Palmer Engine Co., however, in addition to modernizing machine shop and assembly facilities, has recently undertaken remodeling of an ex-foundry building on their premises which will be used for their new Diesel engine program. With this program, Mr. R. C. Bolling, president, stated, "we expect to produce approximately twice the engines in 1960, which were produced in 1959."

L. E. Nelson, vice-president, Chrysler Marine Division, said that their plant consolidated production facilities in one central plant early in 1959 and late last fall. Chrysler Marine now has completely modern and centralized manufacturing facilities, considered by Mr. Nelson to be the "most modern and efficient engine line in

(*Turn to page* 108, *please*)

INDEX TRENDS—RECREATIONAL CRAFT

Report to the Month of MAY, 1959

Number of Reporting Companies: 98

Shipments	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Monthly Average
1947	—	—	—	—	—	—	—	—	—	—	—	—	97.4
1948	—	—	—	—	—	—	—	—	—	—	—	—	113.9
1949	—	—	—	—	—	—	—	—	—	—	—	—	88.7
1950	—	—	—	—	—	—	—	—	—	—	—	—	121.4
1951	—	—	—	—	—	—	—	—	—	—	—	—	126.8
1952	—	—	—	—	—	—	—	—	—	—	—	—	142.6
1953	—	—	—	—	—	—	—	—	—	—	—	—	217.5
1954	189.3	290.2	434.1	557.2	512.5	478.1	321.4	220.5	133.4	136.7	152.9	196.2	301.9
1955	233.1	359.6	600.6	767.3	754.8	689.6	512.9	363.4	208.6	274.3	283.7	320.8	447.4
1956	443.8	568.0	927.6	1093.9	1205.5	939.4	577.9	392.0	298.5	352.4	342.4	389.1	627.5
1957	534.8	749.4	1270.5	1292.9	1363.4	1210.9	878.8	527.7	364.5	446.4	431.5	515.7	798.9
1958	621.1	823.9	1348.2	1635.1	1609.9	1323.9	929.1	605.8	537.3	618.8	588.3	755.9	949.8
1959	809.9	1203.3	1859.6	2239.9	2229.3	—	—	—	—	—	—	—	—
Orders Received *													
1958	—	—	—	—	—	—	749.7	664.3	717.9	952.0	798.1	1031.0	
1959	1328.8	1739.9	2619.0	2367.7	1980.9	—	—	—	—	—	—	—	
Cancellations													
1958	—	—	—	—	—	—	21.5	23.4	14.8	17.6	34.0	24.0	
1959	50.0	49.2	90.8	234.0	195.7	—	—	—	—	—	—	—	
Orders on Hand at End of Month													
1958	—	—	—	—	—	466.2	265.3	300.4	466.2	781.8	957.6	1208.7	
1959	1677.8	2165.0	2833.6	2827.4	2383.3	—	—	—	—	—	—	—	

NOTE: All indices are based on Average Monthly Net Shipments, 1947-1949 = 100.0.
* Unconfirmed Orders are not included.
CONSOLIDATED INDUSTRY REPORT—Statistical Program of the National Association of Engine and Boat Manufacturers, Inc. As compiled by: Ernst & Ernst, Independent Public Accountants, 120 Broadway, New York 5, N. Y.

Balancing the V-6 GMC Truck Engine

WHILE the V-6 engine was under development for GMC Truck and Coach Division's forthcoming new line of trucks the entire design was subjected to searching analysis as a matter of course since these engines doubtless will replace the present conventional engines in the new vehicles. (See page 62 of this issue for description of the new engines.)

However, one of the projects involved analysis and actual testing of a prototype engine to investigate powerplant mass balance and evaluate the behavior of the assembly from the standpoint of roughness and vibration. This step was essential since the engine design group had decided definitely that the V-6 would not embody any special balance mechanism to supplement the natural balance of the counterweighted crankshaft and the fine balance of rotating and reciprocating components.

Mathematical analysis of engine balance indicated that a secondary state of unbalance (at twice engine speed) did indeed exist. And this was resolved in the form of vertical and horizontal components of such forces as indicated by formulas 1 and 2 in Fig. 1. If such forces were significant and resulted in appreciable roughness, then it might be desirable to introduce an equivalent counterweight as indicated in equation 3. Finally, this analysis developed equation 4—the anticipated degree of engine movement due to the inherent unbalanced forces.

The key to the symbols in Fig. 1 is given in tabular form below.

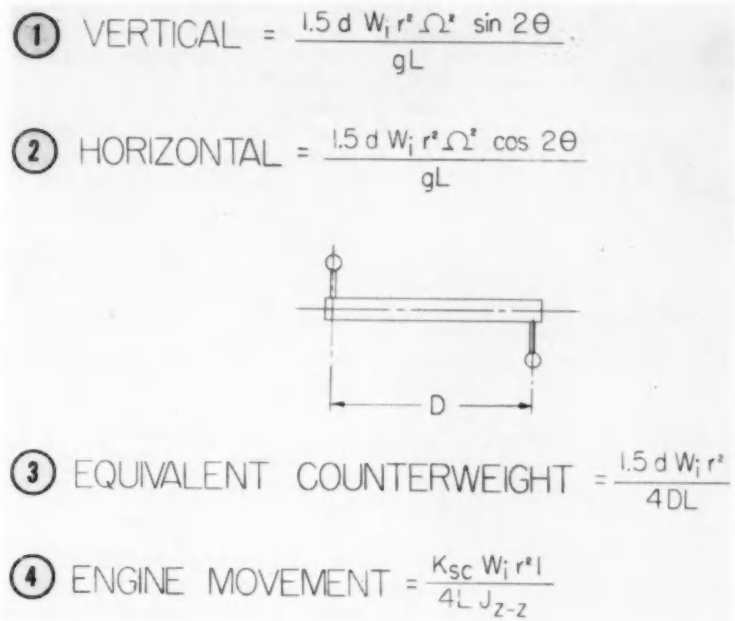
The final step in the analysis was the solution of equation 4, using the actual numerical values associated with the initial test engine prototypes. Fortunately, GMC has on hand an electronic computer which made such calculations quick and simple and provided the numerical results in short order.

The answer, in terms of engine movement, was obtained for the double amplitude since the forces with which they were dealing were in the secondary couples. For the GMC V-6 the numerical values thus obtained indicated that the displacement at the ends of the powerplant should be of the order of 0.0014 in. GMC designers concluded this amount could be absorbed by the engine recounts.

However, the availability of actual engine prototypes made it possible to test this conclusion in a practical manner. To this end the test engine without transmission was mounted freely on very low rate rubber bellows. The test rig consisted basically of three air springs (similar to those used in GMC coaches) mounted to the engine by brackets. Thus the air springs (similar to those used in standard motor mounts and in about the same location.

(*Turn to page* 108, *please*)

FIG. 1


1 VERTICAL = 1.5 d Wi r² Ω² sin 2θ / gL
2 HORIZONTAL = 1.5 d Wi r² Ω² cos 2θ / gL
D
3 EQUIVALENT COUNTERWEIGHT = 1.5 d Wi r² / 4DL
4 ENGINE MOVEMENT = Ksc Wi r² l / 4L Jz-z

d = spacing - outer main bearings.

Wi = reciprocating weight per cylinder.

r = crank radius = stroke / 2

Ω = angular velocity radians/sec.

θ = crank angle.

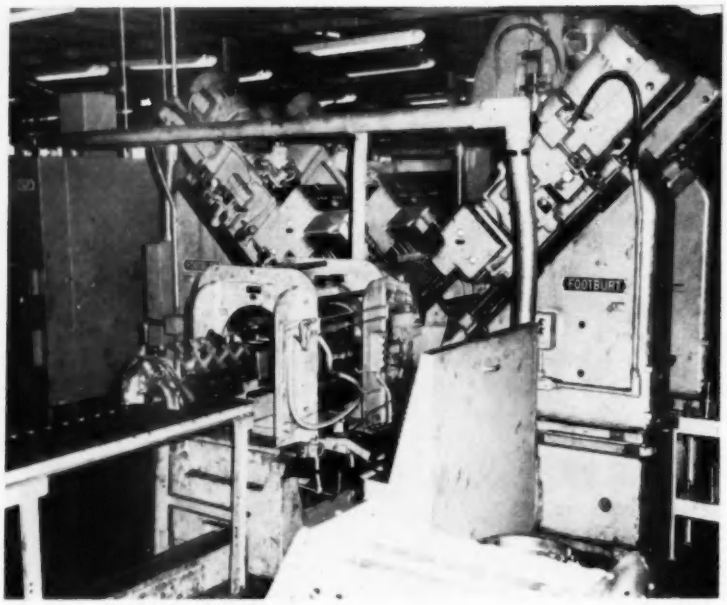
L = connecting rod length.

D = counterweight spacing.

Ksc = Ratio between secondary couple and the single cylinder secondary inertia force with unit lever arm.

Jz-z = Polar moment of inertia of engine, clutch and transmission assembly about axis z-z.

l = distance between motor supports or points at which engine motion is to be measured.



This 15-station Footburt transfer machine is used to drill all expansion plug and drain holes in angular planes; drill oil pan-rail, main bearing cap and bearing oil holes.

Machining Cylinder Blocks *on* Advanced Transfer Machines

International Harvester Co. Produces Cylinder Blocks for Three Basic Engines in Setup which Handles Units of Different Bank Heights on Same Equipment

RECENTLY (AI, May 1, 1959) International Harvester Co. announced a new family of V-8 engines for its B-line trucks. It consists of three basic engines—V-266 with bore and stroke of 3⅝ by 3 7/32 in.; V-304 with bore and stroke of 3⅞ by 3 7/32 in.; and the V-345 with bore and stroke of 3⅞ by 3 21/32 in. Designedly these engines have considerable interchangeability of major components to facilitate mass production manufacturing. For example, the cylinder blocks are quite similar in most respects, one major difference being in the diameter of the bore.

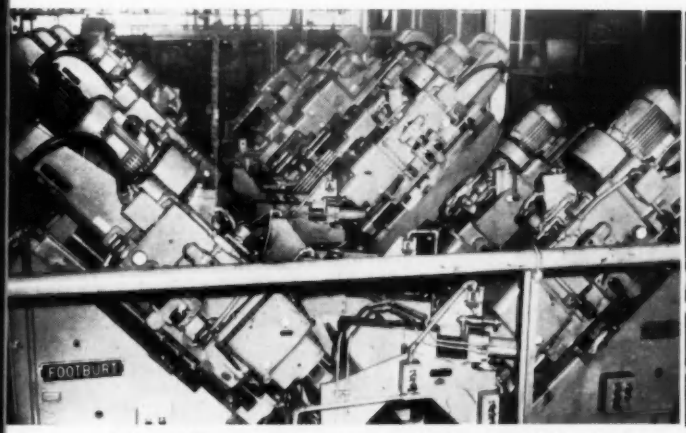
On the other hand, there are actually two different cylinder block castings, incorporating two different cylinder bank heights. As will be noted later, this demanded considerable ingenuity in the design of the milling stations of the Ingersoll transfer machine as well as in other equipment similarly affected.

Design concepts in the development of the family of V-8 engines, together with special features introduced by the manufacturers of the transfer machines, have made it feasible for Harvester to equip its Indianapolis engine plant with transfer machines of advanced type for many of the components, notably for the cylinder block, head, main bearings, and others. As a matter of fact, the transfer machines found here are quite similar to equipment found in mass production passenger car engine plants. There is a major difference, however. At Harvester the transfer machines are endowed with special features that permit cylinder blocks and heads of different dimensional characteristics to be machined over the same equipment.

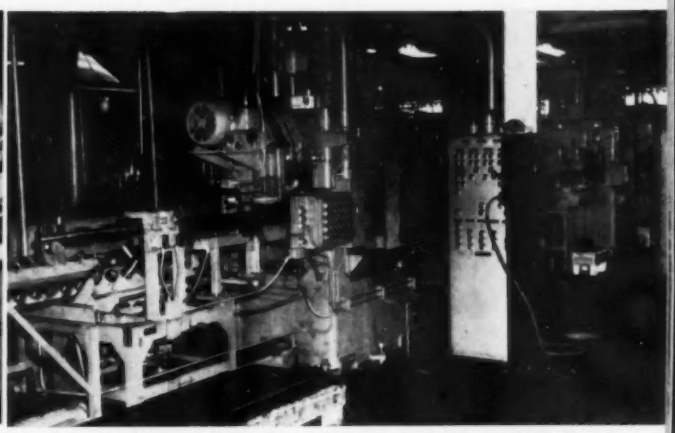
In the case of the Ingersoll transfer milling machine there is a noteworthy arrangement for automatically presetting the milling heads to accommodate cylinder blocks with different cylinder bank heights. This is accomplished in an initial checking station which senses the height of the bank and automatically presets the milling heads to this dimension. The heads, in turn, are raised or lowered in accordance with the signal from the sensing station.

Similarly, the last of the Ingersoll transfer machines, the 11-station unit, has an important inspection station at Station 8. Its function is to probe the bores to make sure that cylinder boring tools are of proper diameter for the block entering the boring stations. This is important because of the fact that the line of engines has two different bore sizes.

It may be noted that the Footburt drilling machines also are affected by differences in cylinder bank heights. It was not feasible to alter head heights automatically on



Perspective, showing arrangement of heads of the 12-station Footburt transfer machine for drilling and tapping head bolt holes, and finishing tappet bores.

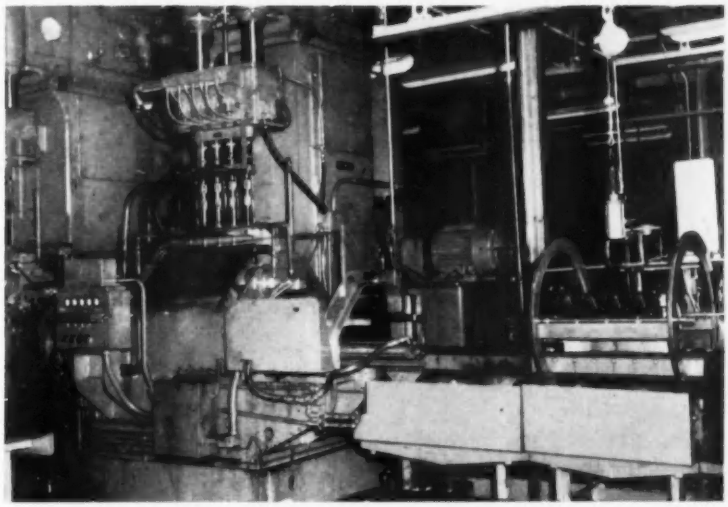


Seven-station Ingersoll transfer machine for semi-finish-boring of cam- and crank-bores; drilling of packing holes; cutting main bearing seal diameters.

PART I

By Joseph Geschelin

DETROIT EDITOR



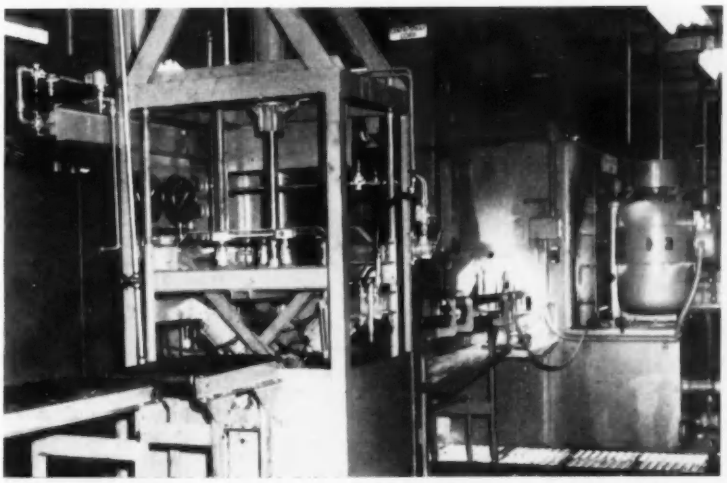
Station type arrangement of Barnesdrill honing equipment for honing cylinder bores. It has two working stations, with a bank of four vertical spindles at each station. The first station, at the extreme left, hones four bores in one bank, then the block is shifted to the second station for honing the other bank. Honing tools are fitted with automatic sizing.

this equipment. Consequently, adjustments are made mechanically to suit blocks that are put through in batches or lots.

It is noteworthy that the major operations on the cylinder block are handled on transfer machines supplied by just three machine tool builders: Ingersoll and Foote-Burt supply the entire transfer machine line; while Barnes has a group of honing machines at the end of the line. Incidentally, the latest versions of the large Centri-Spray washing machines are installed throughout this facility.

It may be noted at this point that cylinder blocks are put through in batches, i.e., the two bore sizes are processed separately since all tools concerned with the cylinder bores have to be changed.

As we follow the sequence of operations given in some detail below, note particularly the provision of automatic inspection or probing stations on the various machines. This is an important attribute of all modern transfer machines, assuring quality and the minimum of rejects or rework. In addition, each



One of a number of the familiar Centri-Spray precision washing machines on the cylinder block line.

of the transfer machines embodies automatic indexing fixtures as well as rollover stations for dumping chips.

Starting with the rough casting the block enters the first of the transfer machines—a 9-station Ingersoll transfer mill. Station 1 is loading; Station 9 unloading. Station 2 mills horizontal and vertical areas on four locating lugs, using two vertical and two horizontal spindles. At Station 3 the block is turned 90-deg with panrail in the vertical plane. In this position Station 4 rough-bores the main bearing half bores. Station 5 rough-mills the panrail and bearing cap seats; also mills bearing cap clearance.

Station 6 finish-mills the panrail; semi-finish- and finish-mills bearing cap seats for depth; and has a short section surface broach for shaving to width and location. Station 7 handles the drilling, chamfering, and reaming of two dowel holes.

Blocks now enter the second Ingersoll transfer machine, a 14-station unit with loading at Station 1, unloading at Station 14. Station 2 rough-mills both ends. Station 3 rough-mills both head faces. Station 4 mills to form the 7-in. radius in each end for fitting the tappet cover. Station 5 checks the bores for proper alignment in preparation for rough-boring cylinder bores at Station 6.

At Station 7 the block is turned 180-deg to get the panrail up; and Station 8 handles the milling of the front end of crank bearing bridges, Station 9 milling the rear end of the bridges. Insert lockslots in main bearings then are milled at Station 10. Station 11 mills the starter face and oil filter pad. Once again there is an inspection station —Station 12—for probing cam pockets for clearance, followed by rough-boring of five cam bores.

Blocks now move through a line-up of four Footburt transfer machines, the first of these being of 16-station type for a variety of miscellaneous operations. Station 2 rough-faces the rear end of the rear cam boss; while at the front end it drills 15 holes, end mills clearance for a gallery hole, core-drills and chamfers two welch plug bores. Station 3, at the rear, finish-faces the rear cam boss, rough- and semi-finish-bores the starter bore, drills rear end of lower gallery hole; at the front end it drills 16 holes.

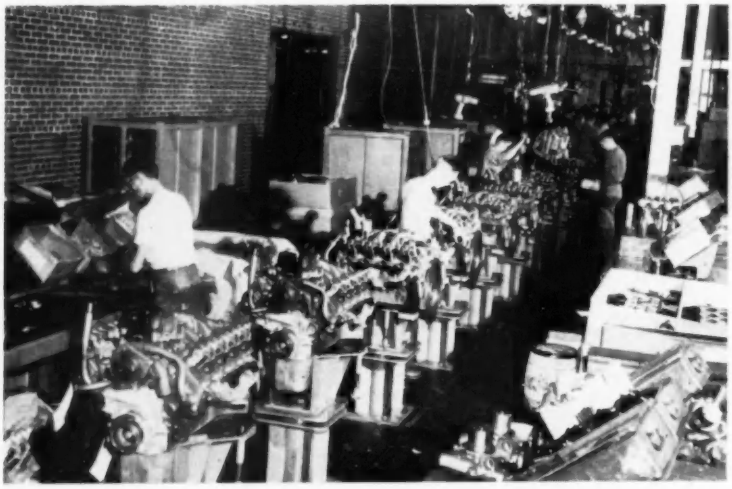
Station 5 drills 14 holes in the rear; six holes in the front end. Station 6 handles 11 holes at the rear; seven holes at the front. Station 8 drills three oil gallery holes at the front end. Station 9 drills three gallery holes at the rear; handles six holes at the front.

Probing of tapped holes is done at Station 12, checking 10 holes at the rear; 26 holes at the front end. Station 14 taps eight holes at the front end; chamfers four tapped holes at the rear. Station 15 taps 11 holes at the rear; 13 holes at the front end.

Next in line is a 19-station Footburt drilling machine for a variety of drilling operations on the sides of the block. These include the starter boss and oil filter attachment holes, etc., at the first four

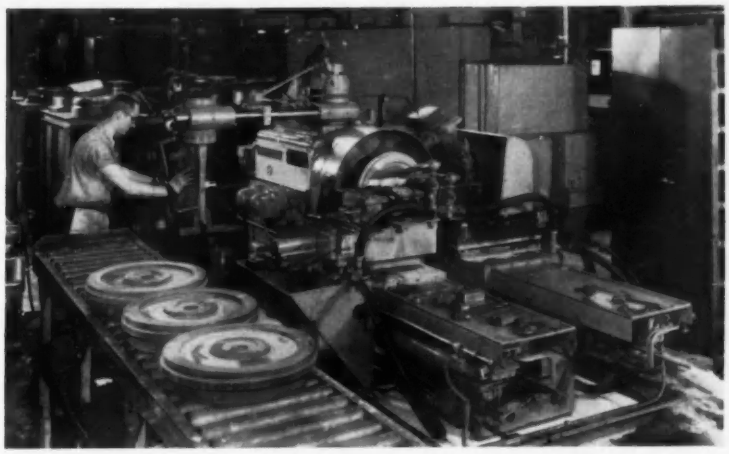
(*Turn to page 92, please*)

V-8 engine assembly is housed in a separate bay, permitting a single straight run of assembly conveyor for the length of the building. This view shows the start of engine assembly with cylinder blocks mounted in vertical position on the stands.



A portion of the engine assembly line as engines near completion. Note how the engine assembly is repositioned on the assembly stands in the several stages of operations in the foreground.

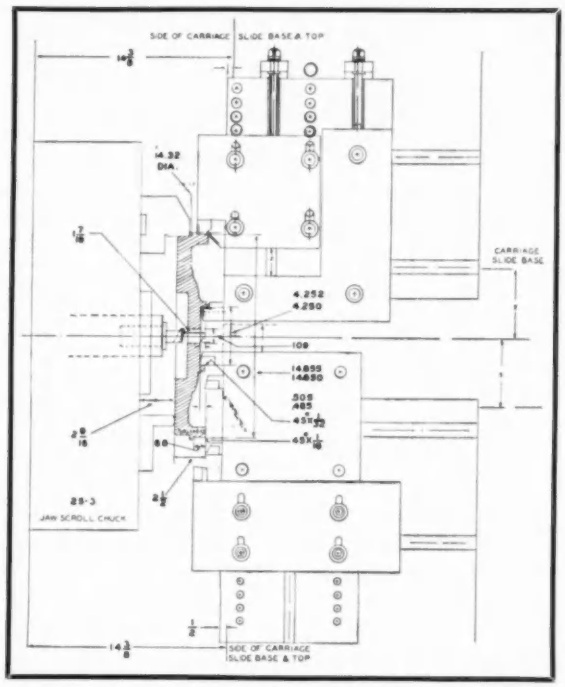
Wide Variety of FLYWHEELS Turned on Automatic Lathes



The No. 24 Gisholt special automatic lathe for machining flywheels. The two coordinated but independent tool slides may be seen in the foreground. Special device for loading and unloading rough castings is seen clearly at the left in the background.

THE versatility and flexibility of modern automatic machine tools are aptly illustrated in the case of a special No. 24 Gisholt automatic lathe which is tooled for producing a variety of large diameter flywheels at the Detroit Diesel Engine Div. of General Motors Corp.

The expanded family of DDE engines currently requires some 10 different flywheels ranging from 13-in. to 22-in. in diameter, the Gisholt lathe being employed for the finishing of the ring gear end of the flywheel. The manufacturing department estimates that it would be feasible and economical to machine as many as 30 different flywheels simply by changing tooling and slide adjustments.



Tool layout for a typical flywheel on the No. 24 Gisholt automatic lathe.

The photographs of this machine shows some of the apparent external features: the 28-in., three-jaw scroll chuck for holding the rough cast iron part; the two independently reciprocating slides; and the special loading device which may be seen at the operator's side. The latter is so articulated as to permit the loading of a rough casting from the station to one side of the machine; from a 90-deg rotation of the mechanism to carry the work into the chuck. The same arm is used for removing a finished part from the chuck and transferring it to the side station for feeding the Bullard which machines the opposite face of the flywheel.

Perhaps the best impression of the operation of the machine, however, may be gained from the tool layout for a typical flywheel. In this drawing the lower slide—the one on the operator's side—has a square closed-circuit sequence of movement. It moves into the work at the start, then outwardly for facing cuts, horizontally to the zero-start position, and finally inwardly at the end of the cycle. This slide handles the roughing operations, employing four cemented-carbide-tipped tool bits.

The other slide has a simple reciprocating movement—into the work for finish-boring of the center pilot, and turning and bevelling the OD. As shown, this slide has three finishing tools. Upon completion of the operation the slide returns to start position.

Among the special features of the machine, not obvious from the outside, is the special back boring attachment which is used for boring the center hole.

It is of interest to note that at the present writing the cutting tools are fitted with brazed cemented-carbide blades. However, work is under way to develop special tool holders suitable for throwaway wafers in the interest of tool cost reduction.

Machining of the flywheel shown in the tool layout has a floor-to-floor time of about seven minutes. ■

• • INDUSTRY STATISTICS • •

WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	Weeks Ending Aug. 1	Weeks Ending July 25	Year to Date 1959	Year to Date 1958
PASSENGER CAR PRODUCTION				
Total—American Motors	8,345	9,688	289,541	110,834
Chrysler	96	156	50,265	35,508
De Soto	11	68	33,965	23,050
Dodge	1,027	1,150	108,946	66,699
Imperial			11,919	8,213
Plymouth	9,766	11,274	306,245	238,754
Total—Chrysler Corp.	10,900	12,648	511,340	372,224
Edsel	419	429	28,270	7,603
Ford	34,377	32,167	972,411	681,098
Lincoln	401	457	17,747	16,079
Mercury	3,132	2,332	95,060	72,161
Total—Ford Motor Co.	38,329	35,385	1,110,488	676,941
Buick	3,654	3,778	158,426	133,111
Cadillac	3,366	3,376	103,568	89,510
Chevrolet	39,390	39,503	1,049,844	830,021
Oldsmobile	9,104	8,807	264,144	203,146
Pontiac	9,246	9,316	289,229	136,675
Total—General Motors Corp.	64,960	64,780	1,865,211	1,392,463
Total—Studebaker-Packard Corp.	.....	1,958	98,039	23,584*
Checker Cab	.....	.....	2,839	2,120
Total—Passenger Cars	122,534	124,439	3,847,458	2,578,166
TRUCK AND BUS PRODUCTION				
Chevrolet	4,341	3,448	250,490	173,016
G. M. C.	2,076	2,192	57,104	36,777
Diamond T	69	78	3,746	3,146
Divco	.....	.....	2,132	1,608
Dodge and Fargo	.....	712	48,462	36,448
Ford	6,697	6,686	209,771	132,467
F. W. D.	19	29	616	795
International	3,613	2,912	91,491	55,356
Mack	376	356	10,286	8,886
Studebaker	246	275	6,326	6,123
White	451	413	11,551	9,861
Willys	2,512	2,663	72,074	49,963
Other Trucks	70	70	2,258	1,850
Total—Trucks	20,470	24,834	768,307	516,296
Buses	5	15	1,605	2,023
Total—Motor Vehicles	143,009	149,288	4,617,370	3,096,485

* Includes Packard.

1959 TRUCK TRAILER SHIPMENTS

Industry Division, Bureau of the Census

Type of Trailer	May	Five Months 1959	Five Months 1958
Vans			
Insulated and refrigerated	367	1,920	1,358
Steel	41	249	173
Aluminum	326	1,671	1,185
Semi-insulated	95	331	218
Steel	95	331	218
Aluminum			
Furniture	177	690	738
Steel	144	550	738
Aluminum	33	140	
All other closed top	2,217	11,045	6,123
Steel	716	3,285	2,098
Aluminum	1,501	7,760	4,025
Open-top	324	1,095	670
Steel	173	447	340
Aluminum	151	648	330
Total—Vans	3,180	15,081	9,107
Tanks			
Non- and low pressure			
Petroleum			
Carbon and alloy steel	246	1,105	983
Stainless steel	27	120	104
Aluminum	135	679	522
Total—Petroleum	408	1,904	1,609
Chemical, food, fluid solids	54	197	325
All other, incl. aircraft refuelers	211	741	294
High Pressure (LPG, chemicals, etc.)	22	146	140
Total—Tanks	695	2,988	2,368
Pole, pipe and logging			
Single axle	28	143	128
Tandem axle	135	418	196
Total	163	561	324
Platforms			
Racks, livestock and stake	39	198	756
Grain bodies, all types	182	765	342
Platforms (flats), all types	1,115	4,248	2,123
Total—Platform	1,336	5,209	3,221
Low-bed heavy haulers	258	1,150	979
Dump trailers	208	1,102	963
All other trailers	302	1,341	674
Total—Complete Trailers	6,142	27,432	17,636
Trailer chassis[1]	280	2,019	1,326
Total—Trailers and Chassis	6,422	29,451	18,962

[1] Sold separately.

NEW PASSENGER CAR REGISTRATIONS BY REGIONS

Zone	Region	May 1959	April 1959	May 1958	Five Months 1959	Five Months 1958	Per Cent Change: May over April	May over May 1958	Five Months 1959 over 1958
1	New England	34,832	33,072	26,411	125,980	106,993	+ 5.32	+31.88	+17.75
2	Middle Atlantic	100,994	105,812	84,345	443,276	373,682	− 4.55	+19.74	+18.62
3	South Atlantic	76,042	68,816	60,002	331,169	254,913	+10.50	+26.73	+29.91
4	East North Central	158,716	153,412	98,557	638,826	460,187	+ 3.46	+61.04	+38.82
5	East South Central	24,658	24,788	16,339	114,020	86,815	− .52	+50.91	+31.34
6	West North Central	55,349	60,555	43,340	231,595	192,393	− 8.60	+27.71	+20.38
7	West South Central	45,929	40,039	34,266	209,820	181,540	+14.71	+34.04	+15.58
8	Mountain	20,087	19,183	14,605	89,969	71,804	+ 4.71	+37.54	+25.30
9	Pacific	65,659	68,100	45,888	311,419	230,845	− 3.58	+43.09	+34.90
	Total—United States	582,266	573,777	423,753	2,496,074	1,959,172	+ 1.48	+37.41	+27.40

States comprising the various regions are: Zone 1—Conn., Me., Mass., N. H., R. I., Vt. Zone 2—N. J., N. Y., Pa. Zone 3—Del., D. of C., Fla., Ga., Md., N. C., S. C., Va., W. Va. Zone 4—Ill., Ind., Mich., Ohio, Wis. Zone 5—Ala., Ky., Miss., Tenn. Zone 6—Iowa, Kan., Minn., Mo., Neb., N. D., S. D. Zone 7—Ark., La., Okla., Tex. Zone 8—Ariz., Colo., Ida., Mont., Nev., N. M., Utah, Wyo. Zone 9—Alas., Cal., Ore., Wash.

1959 TRUCK FACTORY SALES BY G.V.W.

As reported by the Automobile Manufacturers Association

	6,000 lb. and less	6,001-10,000 lb.	10,001-14,000 lb.	14,001-16,000 lb.	16,001-19,500 lb.	19,501-26,000 lb.	26,001-33,000 lb.	33,000 lb. and over	Total
Total—First Quarter	159,906	46,596	3,915	25,857	35,133	15,806	10,358	9,801	307,372
April	57,486	19,406	1,520	10,413	14,368	5,700	4,062	3,953	116,910
May	58,271	17,377	1,433	9,943	15,105	5,592	3,550	3,724	114,995
June	59,482	18,003	1,623	11,646	14,203	6,856	3,901	3,828	119,544
Total—6 Mos. 1959	335,145	101,384	8,491	57,859	78,809	33,956	21,871	21,306	658,821
Total—6 Mos. 1958	215,535	65,786	7,311	46,025	51,593	27,700	15,658	14,693	444,301

Report from the

FARM EQUIPMENT INDUSTRY

Farm Equipment Makers are Betting Heavily on Continued Rise in Sales. Many Companies Report Huge Expenditures to Meet Expected Demand for 450,000 Units in '70.

Farm Equipment Producers Investing Millions in Increasing Business

International Harvester Spends $5 Million for Research

One of the country's oldest and best known producers of all types of farm equipment, International Harvester, has spent over $5 million for a 455,000 sq-ft research laboratory. Complete, the installation includes 10 cells for engine test, plus an additional two for developing and testing LP-gas engines—exclusively.

The facility matches up to any in the automotive and aircraft industries for capability and the extensiveness of research which it can handle. For example, complete pieces of equipment can be examined in controlled atmospheres at temperatures ranging from —65 to 125 F under simulated operating conditions. A huge "shaking" machine has been installed to check production models for their ability to withstand typical vibration and shock encountered in normal day-to-day field operations. Even plowing units can be evaluated indoors under controlled soil conditions.

Allis-Chalmers new Model 50 forage harvester features five-foot direct cut grass attachment

Oliver Corp. Expands Branch Distribution Facilities

The Oliver Corp., another long-time producer of quality farm equipment, has expanded its branch distribution facilities in Peoria, Ill., with the addition of a new sales office and warehouse built on a 17-acre tract. From here the company will better service growing regional markets for its agricultural and industrial products.

Massey-Ferguson Buys Standard Motors Tractor Interests

Massey-Ferguson, Ltd. of Toronto, Ont., announced the purchase of all tractor manufacturing assets and interests of Standard Motors Co., Ltd., England. Pending stockholder approval, the Canadian producer will have production centers in England and France with a joint capacity of 125,000 tractors per year. The $32 million move is in line with Massey's policy to produce more of its own products. Earlier in the year, the company acquired the British light Diesel engine firm of F. Perkins, Ltd., in another expansion deal.

The Reason for Expansion

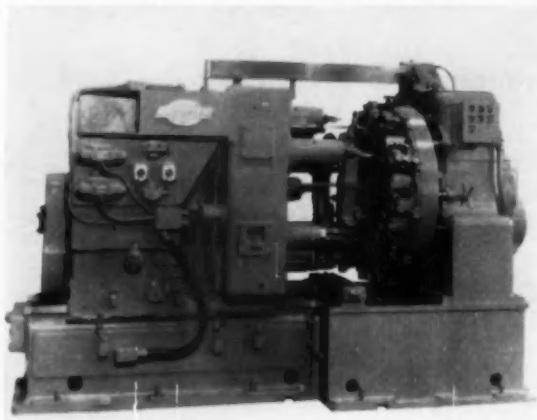
The industry predicts that by 1970, 450,000 farm units will be sold yearly. That, as compared to the estimated 300,000 next year. In order to get this increased business, makers will have to, more than ever before, assure prospective buyers of the quality and availability of their products in the years to come. And company sponsored investigations into higher powered, higher capacity quality machinery will play an important part in securing the big farm equipment dollars sure to come.

(*Turn to page* 112, *please*)

NEW PRODUCTION and PLANT EQUIPMENT

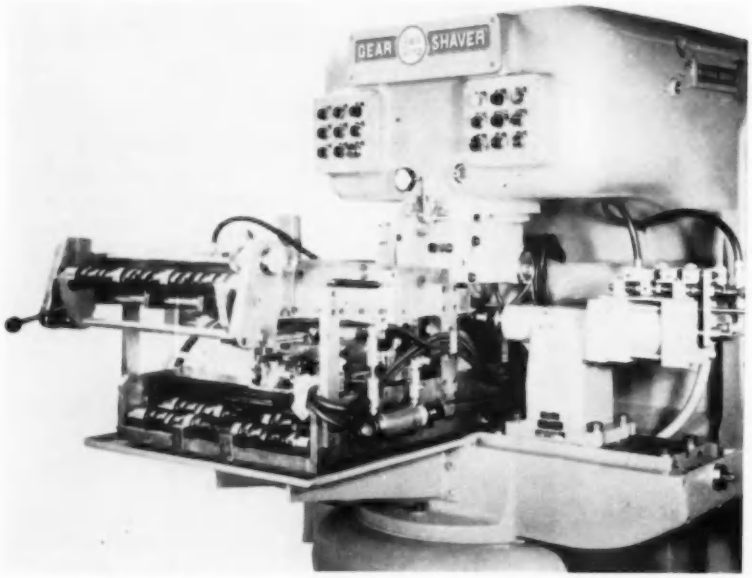
FOR ADDITIONAL INFORMATION, please use reply card at back of issue

One-Way, 12-Station Horizontal Indexing Machine



Oil pump bodies are machined on this one-way, 12-station, horizontal indexing machine. The unit produces 97 pieces per hour gross. Drilling, reaming, and boring operations are performed during the 37.2 second machining cycle. Two clusters of reamers operate at accelerated feed rates. Hardened and ground steel ways are standard equipment. (Greenlee Bros. & Co.)

Circle 31 on postcard for more data



Red Ring slide-type fully automatic loader for handling long, slender parts

Slide-Type Automatic Loader for Long, Slender Parts

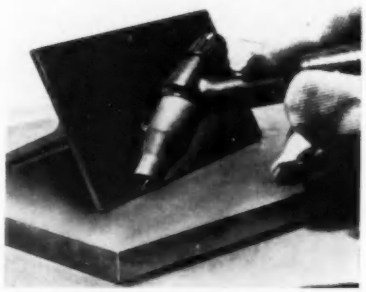
A NEW Red Ring slide-type fully automatic loader for handling long, slender parts on gear shaving or gear honing machines features an air-cushioned exit motion and an air-powered steady rest. Parts such as automotive camshafts are loaded into the inlet magazine in the loader and pass through a pair of gaging master gears to check for any oversize condition of the gear to be shaved or honed. In the inlet magazine, the gears are spaced apart by a series of linkages that automatically advance each shaft part as one is fed into mesh with the cutter or honing tool for the finishing operation.

This type of automatic loader requires the operator to only keep the inlet magazine full of parts and remove the finished parts from the exit chute. They can also be installed in fully automated lines. *National Broach & Machine Co.*

Circle 32 on postcard for more data

Welding Holder

A NEW 350 ampere water-cooled manual Heliweld holder, the H35-B, can be used to weld stainless steel, aluminum, copper, brass, magnesium, and other special metals and alloys in a welding range thickness from paper-thin to ⅛ in. or heavier, depending on the type of metal and type of current employed.



Air Reduction H35-B Heliweld holder

Features of the holder include a completely enclosed water cooling system which minimizes leakage and requires no "O" rings; transparent plastic tubing on all hose assemblies to allow a visual check on water flow at all times; high temperature plastic holder body designed to withstand service temperatures up to 500 F; and hoses equipped with nuts and glands for easy removal. *Air Reduction Sales Co., a Div. of Air Reduction Co., Inc.*

Circle 33 on postcard for more data

Bed Gap Lathe

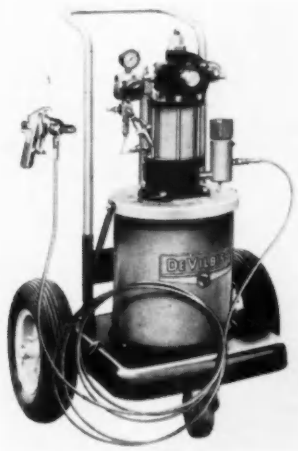
THE Model HXB 26/45 in. heavy duty lathe offers precision machining capabilities for turning and facing a wide variety of heavy duty work. The double-purpose Nebel extension bed gap lathe can operate as an engine lathe with 26½ in. swing over the bedways, or as a gap lathe for large, odd-shaped parts, with 46 in. swing through the gap. A 75 percent increase in distance between centers is available by opening the gap, the distance being 48 in. with gap closed, 84 in. with gap open.

The three-bearing spindle is mounted at the front and center supports on zero precision, angular tapered roller type bearings, preloaded and adjusted for maximum radial and thrust loads. At the rear, the third bearing, radial type, provides for longitudinal spindle expansion. The spindle itself is an alloy steel forging, completely ground, with hardened nose. Easily controlled by two levers and color keyed speed plates, 18 gear driven speeds may be simply selected from a direct reading color index. *The Nebel Machine Tool Corp.*

Circle 34 on postcard for more data

Spray Painting Equipment

INTRODUCTION of airless spray painting equipment has been announced by the *DeVilbiss Co.* The airless method provides specific advantages in painting such items as heavy machinery, interior structures and other surfaces where exhaust facilities for the removal of vapors and over-spray are limited.



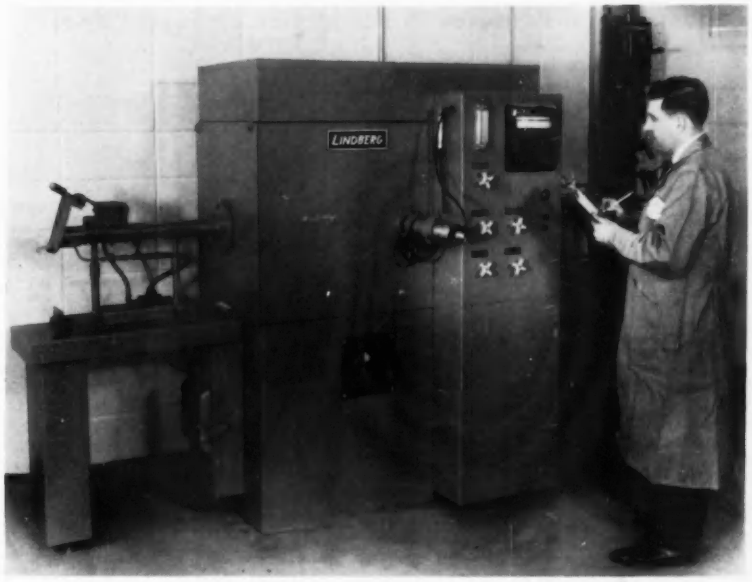
DeVilbiss airless spray painting unit

On exterior painting, the method permits rapid coverage with wide spray patterns without creating excessive mist and rebound.

The unit is portable, and consists of pump, cart, tank, lid, air-motor-driven agitator, elevator to raise the pump when changing material containers, wire braid reinforced Teflon lined hose and airless spray gun with tungsten carbide spray cap.

The principle of airless spraying is the forcing of material through a small orifice at pressures of from 1800 to 2400 psi. When the material is released from this high pressure, it expands and breaks up into small particles. These atomized particles have enough velocity to carry them to the work surface, but not enough to rebound.

Circle 36 on postcard for more data



Lindberg Type TR25-212C18 high temperature graphite tube furnace

High Temperature Graphite Tube Furnace

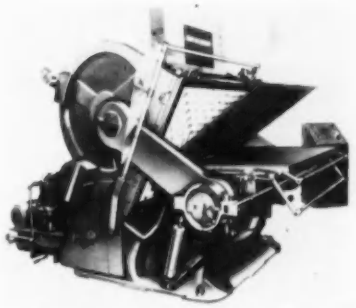
THE Type TR25-212C18 graphite tube furnace has been developed to meet the demands of the metals, ceramic and petroleum industries for controlled high temperatures. The overall operating temperature range of 1600 to 5000 F makes it suitable for a variety of applications including sintering of powdered metals, high temperature investigations and firing of ceramic bodies, and high temperature chemical reactions for the petroleum industry. *The Pilot Plant Equipment Div. of Lindberg Engineering Co.*

Circle 35 on postcard for more data

Die Cutting Press

FEATURING 100 tons of die cutting capacity, the 44 by 66 AC-DM and 38 by 54 AC-DM air double clutch micrometer presses are equipped with a master control station that permits continuous or automatic start-stop operation with a pre-set timer.

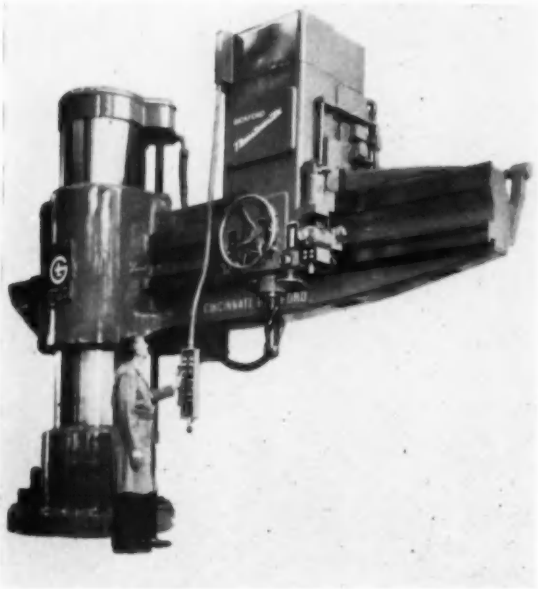
The double micrometer adjustment allows each side of the platen to be individually adjusted in increments as small as one-sixth of a thousandth of an inch. Both presses have an integral air compressor and a pre-wired electrical panel. *Thomson-National Press Co., Inc.*



Thomson-National die cutting press

Circle 37 on postcard for more data

Giant Radial Features Pre-Selection of Feeds, Speeds



Cincinnati - Bickford 34 in. diameter column radial features complete pre-selection of feeds and speeds while the spindle is running, providing fast, simple operation. Feeds are selected by a rotary valve manually positioned. Speeds are selected by an electrical selector switch which controls a series of solenoid valves.

NEW 34 in. diameter column Cincinnati Bickford radials feature 10, 12, or 14 ft arms, full pendant control, rapid traverse to spindle, power-assist for swinging the arm, and complete pre-selection of 32 speeds and 18 feeds.

Full pendant control is provided to enable the operator to easily manage the machine, regardless of the position of the arm. Pushbuttons in the pendant operate the power rapid traverse to the spindle and to the head, power engagement of the driving clutch, hydraulic head and column clamps, control of the arm movement, and up or down.

Spindle construction is designed to take the brunt of heavy thrust loads generated by the use of large drilling and backfacing tools. Seven angular-contact anti-friction bearings support the spindle. Four bearings take direct vertical thrust while the other three carry backfacing loads.

Power for heavy drilling loads at slow speeds is transmitted to the spindle through a large herringbone driving gear. When high speeds are desired, the herringbone gear is declutched and the drive is taken through a smaller spur gear. This is said to eliminate flywheel effect. *The Cincinnati Bickford Div., Giddings & Lewis Machine Tool Co.*

Circle 38 on postcard for more data

Thread Rolling Machine

A SMALL range thread rolling machine, designated Lan-Nu-Rol is said to be capable of handling diameters up to 2 in. (8 threads per inch or finer) with the "infeed" method of rolling and up to ¾ in. (10 threads per inch or finer) when using the "thru-feed" method.

The machine is pneumatically or (optionally) hydraulically operated. Spindle speeds are adjustable from 166 to 500 rpm through a pulley arrangement which requires no gear changing. The range of spindle speeds allows each diameter within the machine's range to be roll threaded at the most efficient speed.

The machine uses two cylindrical thread rolling dies mounted on inclinable roll holders adjustable to 10 degrees left or right hand. The 10 degree inclination handles all AN, UN, and Acme thread forms within the machine's capacity. *Landis Machine Co.*

Circle 39 on postcard for more data

Spindle Assemblies

A REDESIGNED and expanded line of cartridge-type spindle assemblies is available in diameters from 1.250 to 2.750 in. The spindles are made for mounting a variety of small cutting tools such as end mills, shank-type and center-hole milling cutters, drills, taps, reamers, counterbores, special tools, etc.

The 28 standard models offer a range of four basic sizes and two methods of mounting the spindle to the machine, along with five types of spindle nose—Morse taper socket, straight hole bore, Jacobs taper nose, arbor-type nose and blank spindle for machining by the user. With a cylindrical cartridge, spindle assemblies can be located in a bored hole in any machine casting of a suitable size, or by means of one of the two types of standard Gilman precision mounting brackets. *Russell T. Gilman, Inc.*

Circle 40 on postcard for more data

Six Spindle Turret Drill

THE Model "O" Burgmaster bench model six spindle turret drill features a revolving turret to confine several machining operations at one location using a single operator. At operator demand, the turret power indexes to bring any of six tools into machining position. Each of the six spindles has a full range of adjustable, automatic indexed stops to control depth of tool entry into the hole. The machine drills, reams, taps, counterbores, countersinks, and laps.

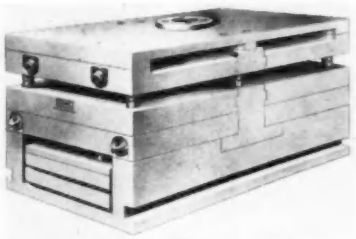
The design of this machine is said to lend itself to machining precision small holes in many components for electronics, instruments, missiles, and other precision devices. *The Burgmaster Corp.*

Circle 41 on postcard for more data

Unit Die Assemblies

A LINE of standard unit die assemblies, available for plastic injection molders, is said to enable the molder to replace cavities at minimum cost and in minimum time.

Three sides of the die are open for easy installation of cores or coolant lines. The twin replacement units are standard 9⅞ by 8 in. to assure availability of cavity plates from stock. *Detroit Mold Engineering Co.*



Detroit standard unit die assembly

Circle 42 on postcard for more data

Drilling Machine

A SNYDER fully automated, five-station special in-line transfer machine that drills and probes holes in truck engine rocker arm shafts at a rate of 211 parts per hour is announced by *Snyder Corp.*

The rocker arm shafts are fed to a transfer way from a hopper feed and escapement mechanism at one end of the machine. A rotating finger transfer bar actuated by a hydraulic cylinder at the end of the transfer way advances the rocker arm shafts from station-to-station for the various drilling and probing operations. Individual parts are lifted a small amount by spring-loaded centering fingers that enter each end during the transfer operations between stations. Clamping fixtures at each station locate the parts for the machining and checking operations. One of the holes produced in the first drilling station is used as a radial locating hole for succeeding drilling, idle, and probing stations.

Circle 43 on postcard for more data

Vertical Toolroom Milling Machine Has High Capacity

U. S. Burke vertical toolroom milling machine's V-belt drive transmits full power of the ¾ hp motor at all six spindle speeds from 250 to 3450 rpm or alternately 185 to 2550 rpm. All controls are located for maximum operator efficiency and convenience. Dials are 3½ in. satin finished chrome. All bearing surfaces are precision ground or hand scraped.

BUILT accurately and ruggedly to accepted machine tool tolerances, this vertical toolroom milling machine, named the Millrite, is designed for precision milling and boring operations.

Equipped with a swivel head, the Millrite is capable of angular, as well as vertical operations. The ram and turret machine has a 7 by 27 in. table with longitudinal feed of 12 in. Quill travel is 4 in. Maximum distance from the spindle nose to the face of the column is 16 in. and maximum distance from the nose to the top of the table is 18 in.

The unit has a hard, chrome plated quill 3¼ in. in diameter. The column is one-piece ribbed, close grain cast iron, and the overarm is internally ribbed with a full 7½ in. diameter flange to which the head is attached.

A feature of the unit is the "Feather Feed" of the quill, using the inherent accuracy and smoothness of a lead screw and nut arrangement. *The U. S. Burke Machine Tool Div.*

Circle 44 on postcard for more data

Electronic Micrometer

THE Model PDR Carson-Dice automatic electronic micrometer gives direct measurements to the fifth decimal place. The instrument comes equipped with two types of micrometer tips. One tip permits measurements on conducting parts to be taken at zero pressure—or no measureable deflection of the part if it is fragile or compressible. For non-conducting materials, or where a star 'ard measuring pressure is desireable, Type J "pre-load" tip is slipped on, providing adjustable hold-down pressures of 1.5, 5, 10, and 20 grams. *J. W. Dice Co.*

Carson-Dice automatic electronic micrometer

Circle 45 on postcard for more data

Power Slitting Shear

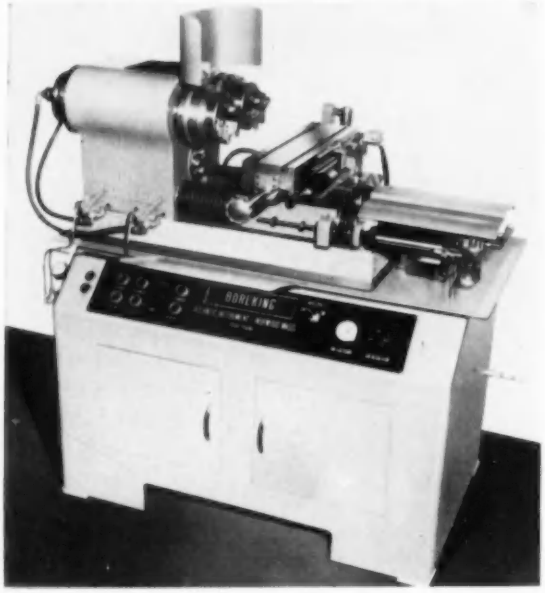
MADE in three sizes, a new power slitting shear has two reversible, interchangeable, high carbon, high chrome cutters which are driven through steel shafts by a heavy duty gear set which is connected to a completely enclosed worm gear drive. An electric motor is directly connected to the worm gear housing to provide safe, positive operation.

Easy-to-read scales on either side of the machine permit direct reading and quick setting of any cutting width from 1½ to 30 in. *Beverly Shear Mfg. Co.*

Circle 46 on postcard for more data

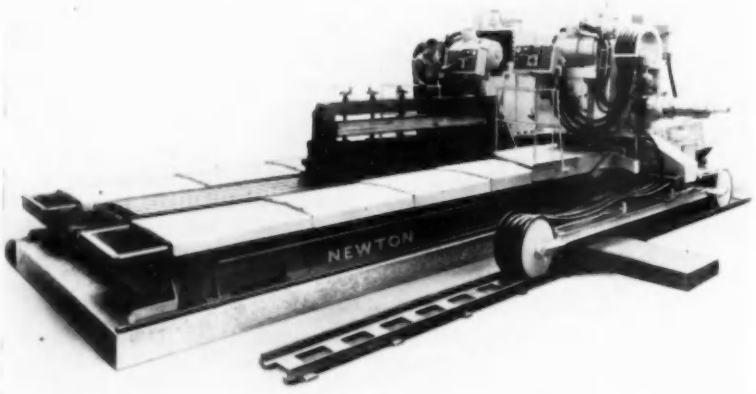
Beverly power slitting shear

Twin-Spindle Cycling, Boring, Turning, Facing Unit



The (Atlantic Instrument Corp.) announces a twin-spindle, automatic cycling, precision boring, turning and facing machine named Boreking. It is designed to perform a complete finishing operation on a blank in one cycle. While the front of the piece is being finished on one spindle, the reverse side may be done on the other. The Boreking is said to be capable of repeating to a tolerance of less than 0.0002 in. on a face cut and 0.00005 in. on a bore.

Circle 47 on postcard for more data



Cavity miller will mill opposing sides of work simultaneously under three-dimensional magnetic-tape control

Machine Cavity Mills Ferrous, Non-Ferrous Metals

THE Farrel-Newton cavity miller is designed to mill ferrous as well as non-ferrous metals. Each spindle is driven by a 60 hp, adjustable speed, d-c motor which, in conjunction with four mechanical changes, gives a cutting speed range of 15 to 3600 rpm.

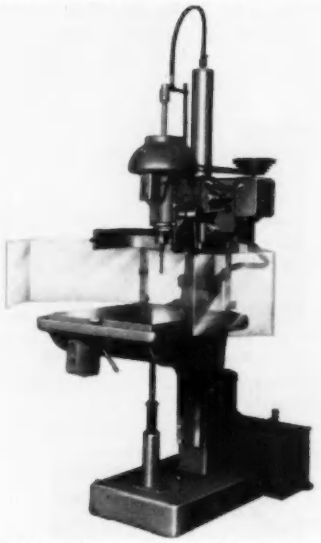
Essentially, the machine consists of a worktable and two opposed traveling-column milling units. Each column carries a head saddle, which travels on a vertical slide. Each head saddle carries a horizontal milling head having "in-out" or depth travel on a horizontal slide. The two milling units are used independently under either manual control or three-dimensional magnetic-tape control.

All feed drives are by electric motors and high-precision reduction gearing. Short, stiff shafting and preloaded bearings are used to achieve low values of backlash and total lost motion. *Farrel-Birmingham Co., Inc., Consolidated Machine Tool Div.*

Circle 48 on postcard for more data

Drilling Machine

THE Buffalo hollow spindle drilling machine is designed for use with "cold point" and "Diamond Impregnated Bits" at speeds up to 10,000 rpm. It has an accurately balanced hollow spindle, coolant system having



Buffalo hollow spindle drilling machine

a pump with a capacity to 100 psi to cool and flush away chips, special splash guards, and a rubber-flex collet chuck. High pump pressure is not necessary when drilling glass or ceramics. Water pumped to the spindle is sufficient. *Buffalo Forge Co.*

Circle 49 on postcard for more data

Cutting, Grinding Tool

THE Ashcombe Airotor is an air driven cutting and grinding instrument for producing small holes, grooves, slots, and die cavities. Operating at spindle speeds in excess of 300,000 rpm, it will grind holes as small as 0.025 in. to tolerances of ±0.0001 in. and will machine hard materials such as ceramics, glass, carbides, and hard metals with diamond and carbide tools.

The Airotor head measures ⅜ in. in diameter by ½ in. long. With a standard carbide bur in the collet, the overall length is less than one inch. The axis of the unit and bur assembly can be changed to a 90 degree position and the instrument can be used as a hand tool, or can be adapted for use with borers, lathes, milling machines, and pantographs. It operates on an air supply of 1.25 cu-fpm at 40 psi and can be attached to standard shop air lines at pressures of 40 to 125 psi. *The Ashcombe Co.*

Circle 50 on postcard for more data

This Mallory Material for These Contact Applications

Palladium Elkonium

gasoline gage
turn signal flasher
voltage regulator

Silver Elkonite

air conditioner solenoid
circuit breaker
starter solenoid

Silver Elkoniums

back-up light switch
circuit breaker
control switches (air conditioner)
convertible top switch
dimmer switch
gasoline gage
horn relay
neutral safety switch
oil pressure gage
overdrive relay
power brake relay
seat adjuster switch
starting relay
stop light switch
vacuum safety switch
voltage regulator

Tungsten

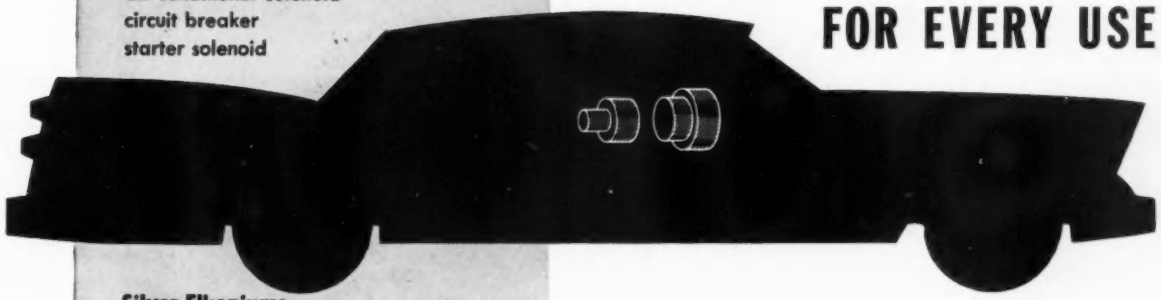
distributor
fuel pump
horn
radio vibrator
voltage regulator

Plated Silver

defroster switch
directional signal switch
dome light switches
heater switch
horn switch
ignition switch
window lift switch
windshield wiper switch

From Mallory

RIGHT CONTACT MATERIAL AT RIGHT PRICE FOR EVERY USE



Mallory offers the widest range of contact materials available. Whatever the requirement, Mallory has the right contact material to meet it . . . and you get it at a price that's right.

Heavy duty? Mallory Elkonite® contacts, a unique combination of conductive and refractory materials, fill the "work-horse" requirement. Medium to light duty? Mallory has a broad variety of materials . . . tungsten, Elkonium® alloys, plated silver and others . . . from which we can recommend the best combination for performance and cost.

A thorough engineering approach to the problems of contact metallurgy and design has been one of Mallory's major contributions to the automotive industry. Mallory's experience extends over 43 years . . . includes pioneering work in powder metallurgy. Our varied and extensive production facilities assure you the most value for your money.

Mallory contact engineers will gladly recommend materials best suited to your requirements. Just write or call for a consultation.

Mallory Metallurgical Co., Indianapolis 6, Ind.
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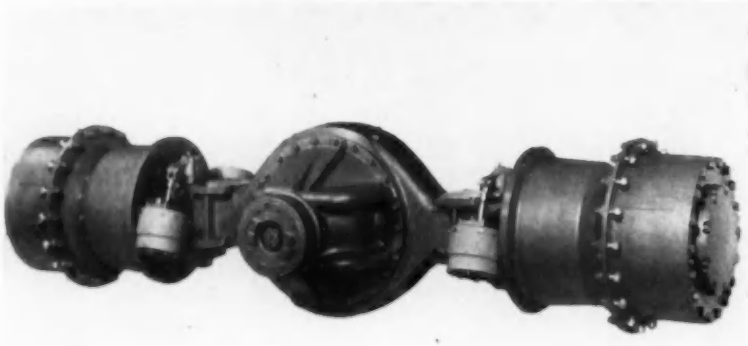
MALLORY

Circle 140 on Inquiry Card for more data

NEW PRODUCTS AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card at back of issue

Planetary Drive Axle for Heavy Duty Equipment



The Model FD-65000 planetary drive axle with double cam air brakes has been designed by the *Clark Equipment Co.* for application on heavy duty equipment.

Load capacity of the new device is rated at 110,000 lb at 0 to 4 mph and 85,000 lb at 25 to 45 mph. Weighing 6800 lb, the axle features a maximum allowable torque at the centerline of the differential of 750,000 in.-lb—on the pinion shaft, 145,000 in.-lb.

Planetary gearing includes three planets mounted on rollers. The differential ring gear has a 25 pitch diameter with a 3¾ in. face. Gear ratios are as follows: differential ratio —5.125 to 1; planetary ratio—4.666 to 1; total axle reduction—23.918 to 1.

Circle 80 on postcard for more data

Single Lug Hose Clamp

Made for low pressure hose and tubing, a one-piece hose clamp has been developed to clamp permanently with only the squeeze of a simple tool.

Named the Single Lug Mechanical-Loc Circle Clamp, it has only one U-shaped locking lug which results in greater speed on the assembly line.

Squeezing the locking lug tight decreases the inside diameter of the clamp so that it firmly binds the hose to its fitting. At the same time, it takes a permanent "set" in place and cannot work loose due to vibration, pressure, twisting, or improper handling.

The clamp is available in 15 standard sizes ranging from 0.42 in. ID to 1.22 in. ID. A double lug variation accommodates diameters to 2⅝ in. Finish is bright electro-cyanide zinc. *Circle Clamp Div., Cuyahoga Products Corp.*

Circle 81 on postcard for more data

Polyester Film

A new laminated polyester film, said to have excellent flexibility and mechanical strength, good electrical properties, high heat resistance, and good resistance to delamination, has been developed by *Mica Insulator Div. of Minnesota Mining & Manufacturing Co.*

Designated as Lamicoid LPF-1 laminated polyester sheet, it consists of two plys of 0.010 in. thick polyester film laminated together with a special bonding agent.

The sheet is presently being used as a U-shaped slot liner in hermetic motors, where resistance to Freon 22 and severe mechanical abuse during assembly are required. It is particularly adapted to applications requiring the formation of simple shapes that are tough, flexible, and will hold their own form, according to the company.

Circle 82 on postcard for more data

Miniature Toggles

A new series of miniature pull-to-unlock toggle switches features a positive lever locking device as an integral part of the switch. Designated the "13AT" series, the switches are available in a variety of combinations, from two-pole through four-pole, with or without gold contacts and/or turret type terminals. Each of the subminiature basic switches in an assembly has a single-pole, double-throw snap contact arrangement. They are listed at 5 amp, 250 vac. The 30 vdc rating includes: inductive, 3 amp at sea level and 2.5 amp at 50,000 ft; resistive, 5 amp at sea level and at 50,000 ft; maximum inrush is 24 amp. The switches have a threaded bushing for panel mounting. *Micro Switch, a Div. of Minneapolis-Honeywell Regulator Co.*

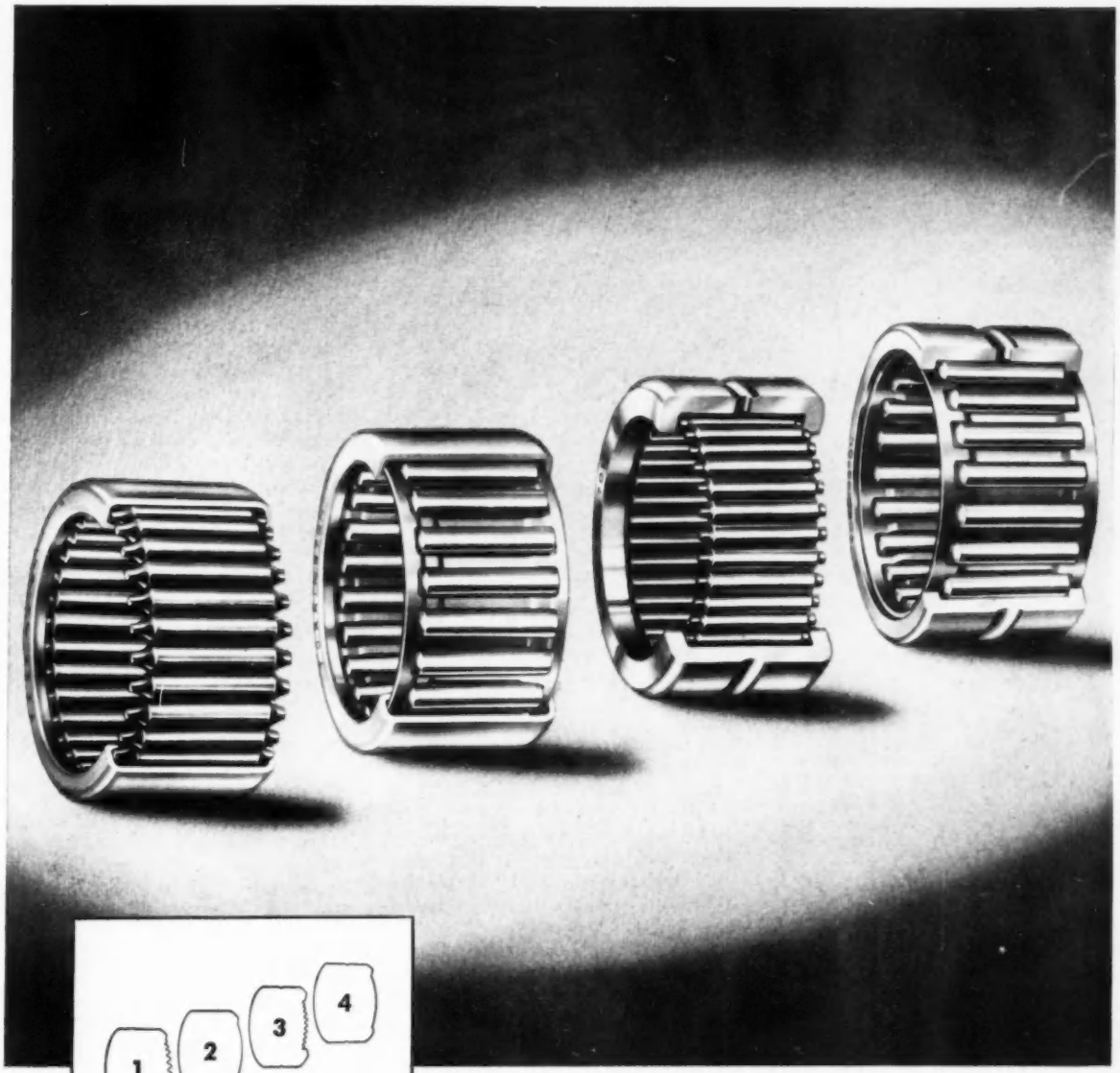
Circle 83 on postcard for more data

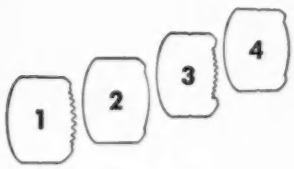
Fabric Fire Wall

An asbestos base fabric, coated with "Viton" synthetic rubber and reinforced with wire of "Inconel" nickel-chromium alloy, has been developed for use as fire-wall seals in supersonic aircraft. It exhibits good heat-resistant properties, is not affected by test fluids and commercial fuels, and can be kept at —40 F for five hours or at 500 F for 96 hours with no tendency to crack or flex. *E. I. du Pont de Nemours & Co.*

Circle 84 on postcard for more data

(*Turn to page* 84, *please*)





Torrington Drawn Cup Needle Bearing . . . for maximum radial capacity in minimum cross section . . . positioned by press fit—snap rings or shoulders unnecessary . . . runs directly on hardened shaft . . . most compact, light weight, economical.

Torrington Drawn Cup Roller Bearing . . . for higher speeds or long pregreased life . . . thin section race for simple press fit . . . runs directly on hardened shafts . . . unit construction for easy assembly . . . shaft-riding retainer.

Torrington Heavy Duty Needle Bearing . . . for use with thin section or split housing where extreme impact loads require heavy outer race . . . maximum shock resistance . . . full roller complement . . . unit construction.

Torrington Heavy Duty Roller Bearing . . . for combination of high speed, long pregreased life or shock resistance . . . roller stability provided by end-guiding . . . flange-riding retainer . . . unit design.

All of these types of bearings are available with inner races.

Only Torrington Makes All Four!

Torrington developed the Needle Bearing and its specialized variations. This breadth of experience assures impartial engineering recommendations based on specific application requirements. You can rely on Torrington to recommend the most compact and economical design compatible with operating conditions and performance requirements. Call on your Torrington representative for help in applying the right bearing in the right place. **The Torrington Company, Torrington, Conn.—and South Bend 21, Indiana.**

TORRINGTON BEARINGS

Every Basic Type of Anti-friction Bearing

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE ROLLERS • BALL • THRUST

Circle 141 on Inquiry Card for more data

Air Control Valves

Two alternate bases are available for the Series CC four-way directional air control valves. All eight ports are tapped ¼ in. or ⅜ in. pipe size and the bottom ports are also O-ring grooved for gasket mounting. Bottom ports are grooved to mount directly to the manifold or pad of a machine. *Hannifin Co.*

Circle 85 on postcard for more data

Hot Gas Motor Pump

Made to provide an auxiliary source of hydraulic power for missiles, this hot gas driven motor pump series will provide power throughout a range of 0.5 hp at 1500 psi to 66 hp at 3000 psi. Speed ratings for the units range from 18,200 rpm for the smallest size with a displacement of 0.095 cu-in./-rev. to 6500 rpm for the largest unit

with a displacement of 2.35 cu-in./rev. While most operation is at 3000 psi, this series is capable of 5000 psi.

The hot-gas motor is a modified standard axial piston-type aircraft hydraulic motor which can be run on both propellant generated hot gases or hot gases bled from the prime propulsion system. *Vickers, Inc.*

Circle 86 on postcard for more data

Aluminum Casters

Featuring sealed bearings, a line of new 5, and 6 in. aluminum casters with 2 in. Neoprene rubber tread wheels, has been developed by the *Bassick Co.*

They are designed for use where corrosive conditions prevail or where casters are frequently exposed to the out-of-doors. Horn surfaces are smooth with no cracks or projections to catch dirt.

Circle 87 on postcard for more data

Overtemperature Guards

Overtemperature protectors, sensitive to all factors which cause motors to overheat, react to current as well as temperature to insure that fuel pump motors do not reach the point where heat would cause auto-ignition of fuel vapors. However, they allow maximum pump output consistent with system requirements.

One of the units in the new series, the Klixon 9644, is suitable for motors up to 1½ hp, 200 v, 400 cycles. It is available in either automatic or non-automatic reset. The actuating element, a snap-acting bi-metallic disk, makes the protector resistant to vibration. The unit has only one moving part and does not require auxiliary relays or signal lights. *Metals & Controls Div. of Texas Instruments, Inc.*

Circle 88 on postcard for more data

Time Delay Relays

Employing silicon transistors, a new line of electronic time delay relays, provides good technical characteristics and high reliability under MIL environmental conditions.

Four different models, which operate at 28 vdc input, have been designed in the standard line. Each is of small size and weight to permit installation under limited conditions of space. A fixed, preset time delay can be provided in each model, ranging from 0.05 to 950 seconds, or greater. Employing a non thermal circuit, reset time is normally negligible. *Hydro-Aire Co., Electronics Div.*

Circle 89 on postcard for more data

Threaded Fasteners

A new thread form designed to increase fatigue life under dynamic loading has been added to the Unbrako socket head cap screw line of the *Standard Pressed Steel Co.*

Featuring a smoothly radiused root, the design is said to greatly reduce failure-producing stress concentrations in the section of a tension screw —the least cross-section area of the thread—where most fatigue breaks occur. The radiused root is said to scale down stress concentrations to a factor of 3.4.

Circle 90 on postcard for more data

Lock-Spindle Rivet

A lock-spindle blind rivet, made in a combination of materials for improved strength characteristics at all temperatures up to 1000 F, is available from *Huck Mfg. Co.*

Designated the MLS blind rivet, the factory-assembled 3-piece fastener consists of a monel sleeve, a pin of 17-4PH stainless steel alloy and a monel locking collar. It is produced in ⅛, 5/32, and 3/16 in. nominal sleeve diameters. Head styles are protruding and 100 degrees countersunk. All sizes are available in 1/16 in. grip increments.

The fastener provides good corrosion resistance and was especially developed for use in stainless steel and high alloy applications. No plating or special treatment of the rivet is necessary.

Circle 91 on postcard for more data

Compact Air Compressor

A lightweight air compressor for automotive and industrial applications has been announced by the *Cummins Engine Co.* It features a single cylinder 12 cu-ft design, a simplified single air intake and outlet assembly, and an integral crankshaft and accessory drive.

The compressor is available for all Cummins H, NH, and six cylinder J and C series engines. The compressor is driven by the engine timing gear train and is water cooled. Its crankshaft and bearings also serve as the shaft and bearings for the accessory drive.

Circle 92 on postcard for more data

Barrel Finishing Media

A new barrel finishing media for zinc die castings which offers fast cutdown, produces a low micro-inch surface, and protects workpieces against surface impingement has been announced by *Minnesota Mining and Manufacturing Co.*

Called "Honite" brand Z-N Tumbling Shape, the media's fine-mesh abrasive qualities are said to produce a finish fine enough to eliminate hand buffing. Shape is that of a truncated pyramid.

Circle 93 on postcard for more data

NAT'S
quick facts
about
Fasteners...

Welding Fasteners...

the little things that make a big difference

Welding Fasteners put threads into the most unlikely places, and make light of the weightiest assembly problems.

Where hands and wrenches can't get in, for instance, or where material dimensions or contours make it next to impossible to use regular fastening methods, Weld Nuts or Weld Screws neatly side-step the difficulties . . . and make assembly simple, fast and foolproof.

We could go on and tell you more about Welding Fastener advantages . . . in improving product design and quality, increasing production efficiency, and cutting costs . . . and we'll be very glad to, if you like.

Right now, though, we'd just like to say that when you need certain standard Weld Nuts or Weld Screws, and you want to be sure they're designed right and made right . . . that's where we come in. We *know* Welding Fasteners, and we *stock* many of the most commonly used.*

We might just mention, too, that we happen to be particularly adept at developing Special Fasteners for welding. They can often be designed to do a better job and save money for you. Ask us about your applications.

*Standard types and sizes are illustrated and listed in National's booklet on Welding Fasteners. Write for your copy.

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The National Screw & Mfg. Company • Cleveland 4, Ohio

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Circle 142 on Inquiry Card for more data

AIRBRIEFS

By David A. Partridge

Tenny Engineering, Consolidated Electrodynamics Join Forces

Keeping pace with the fast moving space age, Tenny Engineering, Inc., and Consolidated Electrodynamics Corp. have joined forces "to meet pressing needs for advanced test equipment to measure the performance and reaction of men and machines in space," according to Robert J. Fulton, vice president of Tenny, and Max Garber, director of marketing, Consolidated's Rochester Div.

The two companies will work together on bidding on environmental chambers, with Tenny the prime contractor, in most instances.

de Havilland to Get Engineering Award

The Elmer A. Sperry Award, one of the most coveted engineering honors, will be presented to de Havilland Aircraft Co., Ltd., for designing and developing the world's first jet-powered passenger transport aircraft, the de Havilland Comet.

The award is sponsored by four engineering societies: The American Society of Mechanical Engineers, the Society of Automotive Engineers, the American Institute of Electrical Engineers, and the Society of Naval Architects and Marine Engineers.

Civil Aircraft Deliveries Rise

Deliveries of civilian aircraft amounted to 759 units in May, an increase of 20 per cent compared with shipments in May, 1958. Value of shipments of complete aircraft and parts during May amounted to $87,680,000 — more than double the value of shipments for the previous year.

Reason for the gain, says the Aerospace Industries Association, is the increase in deliveries of turbine-powered transports. A survey made by the association points out that U. S. makers delivered 127 units to U. S. scheduled carriers by mid-July and that by the end of this year another 160 will be delivered. In addition, some turbine airliners have been shipped to foreign airlines.

Aircraft Employment Declines

Preliminary manpower figures, prepared by the Bureau of Labor Statistics, state that aircraft and parts industry employment totals dropped, for the first time since 1956, to second place behind the automotive industry.

Automobile manufacturing employment was 752,900 in May compared with 743,600 for aircraft and parts. Peak in the aircraft industry in recent years was recorded in 1957 with an average of 861,700 workers on aircraft company payrolls.

Canadian Aircraft Firms to Build Starfighters

After evaluation of more than 20 British, American and European aircraft, Canadian Defense Minister George Pearkes announced the selection of Lockheed F-104 Starfighters for eight Royal Canadian Air Force Squadrons serving with NATO forces in Europe.

According to Burt C. Monesmith, Lockheed California Div. vice president and general manager, the next steps in negotiating the final program will involve a licensing deal for companies in Canada to build both the Lockheed-built F-104 airframe and its J-79 engine, now produced by General Electric Co. ■

Needle-nose F-104A. Lockheed "missile-with-a-man in it" is similar to configuration selected by Canada for eight Royal Canadian Air Force Squadrons serving with NATO forces in Europe. This airplane holds three world's records for aircraft performance—speed (1404 mph), altitude (91,234 ft), also time-to-climb records.

17

Dole Thermostats are standard equipment on seventeen (17) out of eighteen (18) leading passenger cars* — also most trucks, tractors and industrial motors

An outstanding reason for this tremendous acceptance is the dependability of product and the company that makes it. And each year, *more* manufacturers specify Dole Thermostats for motor temperature control. They are *sold* . . . sold on Dole's program of continuous research and development, and its constant adherence to highest standards of quality in engineering and manufacturing.

*as listed in Automotive News

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News of the MACHINERY INDUSTRIES

By Charles A. Weinert

The Cross Co. Is Building a Plant in Germany for the Manufacture of Special Machine Tools to Improve Its Competitive Position in World Markets

Cross Company Is Building in Europe

The Cross Co. is erecting a new plant in Germany for the manufacture of special machine tools. This fact was revealed by Ralph Cross, executive vice-president of the firm, at a hearing held recently in Washington before a Senate Banking & Currency Subcommittee on International Finance. The finance committee is studying the effects of American investments abroad on the U. S. economy.

In making known his company's plans, Cross said that the primary goal of the move was the development of business in Europe, South America, Australia, and Africa. In effect, Cross told the committee that because of current U. S. wage levels and projected wage trends, his company is building abroad to protect and improve its competitive position in growing world markets.

Cross also told the senators he hopes to develop two-way trade between the European and American plants of his company. "By importing items that can be made more cheaply in Europe and exporting services best supplied from here, the company will have a competitive edge in both domestic and foreign markets," he stated.

"Markets in Europe and other foreign countries are expanding rapidly. This, coupled with very favorable wage rates, depreciation and other tax benefits, creates an excellent investment opportunity for maximum return to the company's stockholders," Cross declared.

The above latest Cross expansion follows an announcement several weeks ago of the company's entry into the nuclear and electronics field through the formation of a new subsidiary, Cross-Malaker Laboratories, Inc., a scientific consulting and engineering firm located in Mountainside, N. J.

Ex-Cell-O Corporation Marks 40th Year

On the occasion of the company's 40th anniversary, Ex-Cell-O Corp. records a growth over the years which is outstanding among the many achievements of American industry.

It all started in 1919, when a small group of Detroit toolmakers formed a company to make parts, small jigs, and tools to standards of precision beyond the capabilities of most plants at that time. Subsequently, drill jig bushings were produced; and, later, precision spindles were developed for improved accuracy of hole-grinding operations.

Then, in the 1920's, research in precision boring was initiated, resulting in the introduction in 1930 of the first Ex-Cell-O precision boring machine—and marking Ex-Cell-O's entry into the machine tool field.

At about this same time (1930), Continental Tool Works was acquired. Continental has concentrated on the manufacture of metal cutting tools, from small form tools to large broaches and including counterborers and inserted-blade face mills.

In 1935, Ex-Cell-O undertook the commercial development of a machine for packaging milk and other dairy products in paper containers. It was put on the market as an Ex-Cell-O product in 1936. Today the Pure-Pak Division's machines package 65 per cent of all milk sold in paper containers.

During the 1930's, the company's Machinery Div. introduced precision thread grinders, way-type boring machines, and special machinery of various types. Immediately following World War II, jet blade profiling machines and vertical boring and contouring machines were introduced.

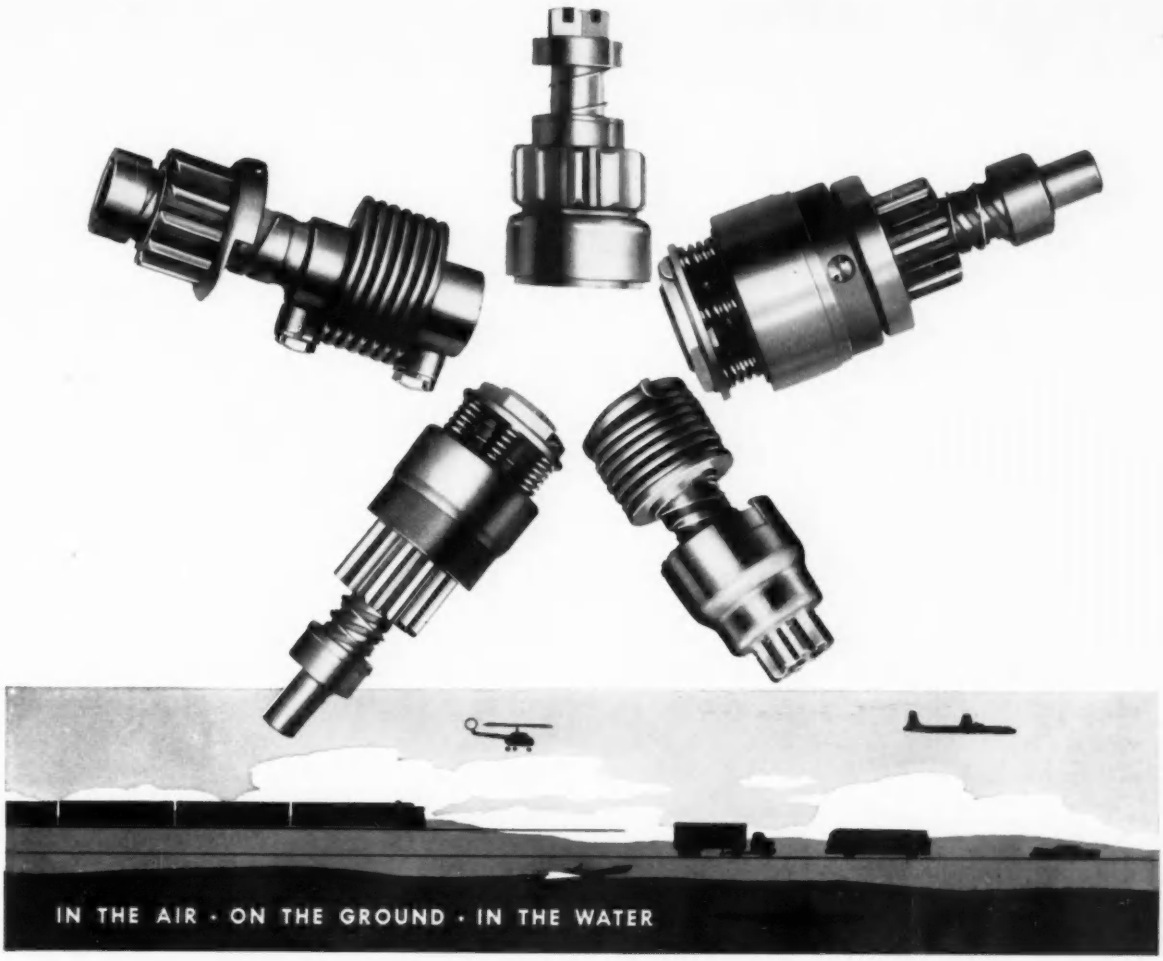
Manufacture of hardened and ground precision parts has always been another of the company's major activities. During World War II, Ex-Cell-O was a large producer of precision aircraft parts, having had manufacturing experience along these lines dating back to 1925.

Ex-Cell-O Corp.—engaged in the fields of machine tool building, cutting tool manufacture, precision parts production, and serving the dairy industry—has had a continuing program of plant expansion. Starting with a floor area in 1919 of only 2375 sq ft, the combined area today of all the company's plants—of which there are 29 located in the United States, Canada, England, Germany, and India—totals over 2½ million square feet.

Machine Tool Orders Still on the Increase

June orders for machine tools totaled $67.3 million—more than doubling June, 1958's bookings and representing the highest monthly volume since March, 1957. The new total was made up of $53.55 million for metal-cutting and $13.75 million for forming type machines. (This up-trend was foreshadowed in the survey of machine tool builders as reported

(*Turn to page* 110, *please*)



YOU START BETTER WITH BENDIX STARTER DRIVES

For nearly fifty years—and in well over 125,000,000 installations—Bendix* Starter Drives have become the accepted standard for automotive vehicles. Not so well known perhaps—but equally important—is the fact that these units are also first choice for aircraft, locomotives, earth movers, inboard and outboard marine engines. In short, whatever the type of internal-combustion engine, you can start it *better* with a Bendix Drive. *REG. U. S. PAT. OFF.

Bendix-Elmira
ECLIPSE MACHINE DIVISION
ELMIRA, NEW YORK

Bendix
AVIATION CORPORATION

Circle 144 on Inquiry Card for more data

NEW CP PORTABLE BROACH GUN CONVERTS ROUND PILOT HOLES TO SHAPES

square

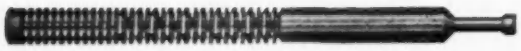
hex

oval

splined

keyed

You take the tool to the work with the CP Portable Broach Gun . . . a completely new technique in broaching. Operation is fast and simple. Broach is inserted in pilot hole and with a squeeze of the trigger the hole is formed or finished in a single, swift operation. Set-up time is eliminated since no jigs, fixtures or templates are required in most applications. Drilled, punched or cast holes can be finished to round, square, hexagon, oval, or irregular shapes in any work area. Angle Broach Puller, for close quarters, is also available.



The broach pulls a clean hole every time, and leaves it "mirror" finished. Hole sizing accuracy can be ±.0002. Unskilled operators can consistently produce accurate holes with minimum training time.

CP Power Cell weighs only 58 pounds, operates on shop air lines, furnishes oil pressure up to 7,000 psi. Easily moved from job to job anywhere in the plant. Also powers hydraulic riveters, squeezers, punches.

Chicago Pneumatic

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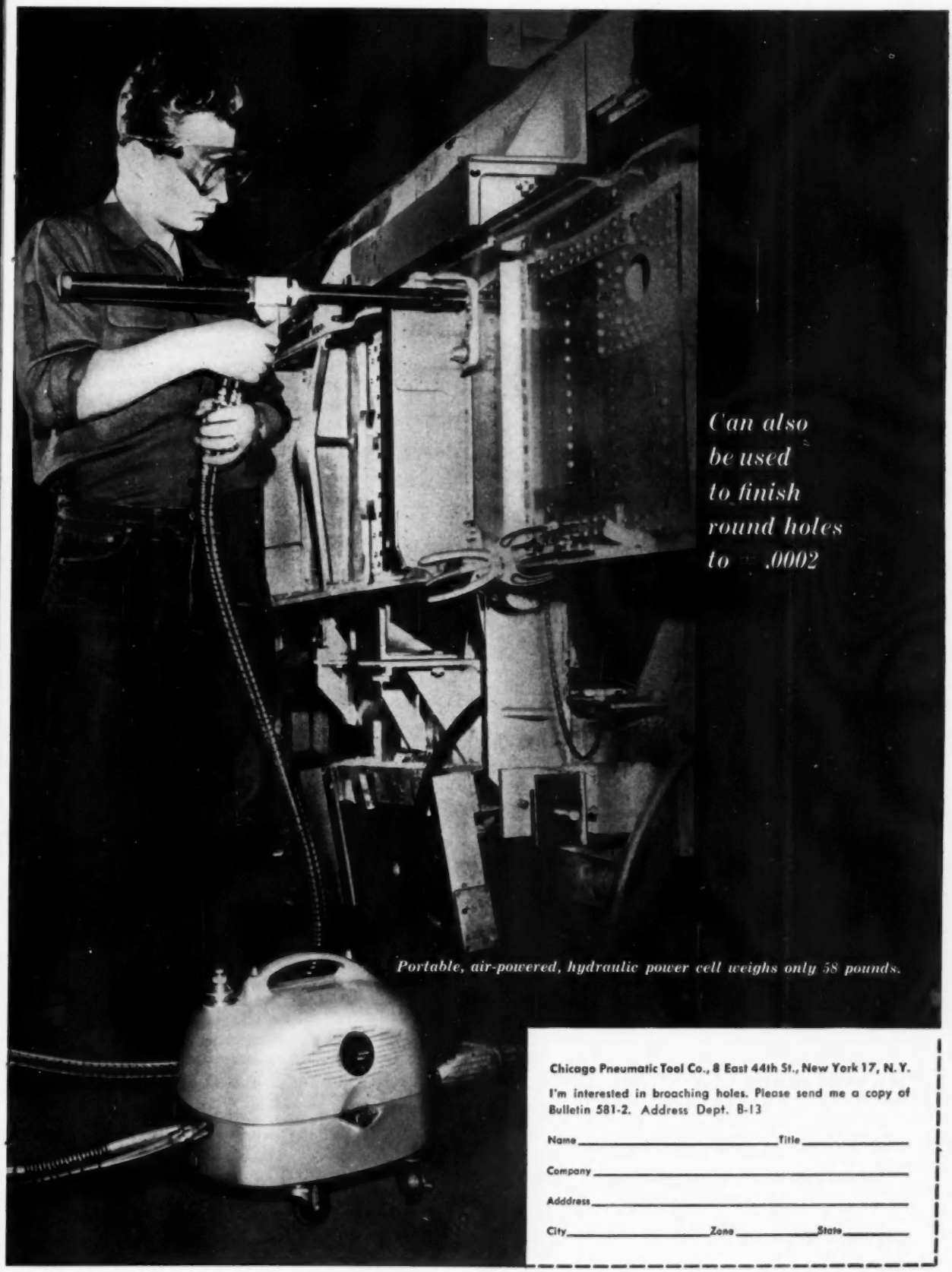
Rock Drills • Hydraulic Tools • Vacuum Pumps • Aviation Accessories



Portable, air-powered, hydraulic power cell weighs only 58 pounds.

Chicago Pneumatic Tool Co., 8 East 44th St., New York 17, N. Y.

I'm interested in broaching holes. Please send me a copy of Bulletin 581-2. Address Dept. B-13

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Circle 145 on Inquiry Card for more data

Machining Cylinder Blocks

(*Continued from page* 72)

working stations; probing of holes at Stations 6 and 7. Eight tappet bores are drilled on each side of Station 8. Ten cylinder head bolt holes are drilled in each bank at Station 11.

Then both banks take 34 water circulating holes at Station 12. This is followed by probing at Station 13, this head checking 54 holes in both banks.

Station 14 chamfers three holes on one side; end-mills 16 holes and drills one hole on the other side. Station 15 taps three holes on one side; drills 16 holes and chamfers one hole on the other side. The 16 holes produced above then are probed at Station 16. A number of other holes are drilled and tapped at Stations 17 and 18.

The block now enters a 15-station Footburt transfer machine and is rotated to present the panrail surface up for operations on both sides and in the main bearing area. Stations 2 and 3 each handle four holes in each side. Station 5 drills 18 holes with one head; 5 holes with another; while Station 6 drills 18 holes with a vertical head, six holes with a horizontal head. Probing of 35 vertical holes and one angular hole is done at Station 7.

Station 8 drills six oil holes with two heads; Station 9 chamfers 30 holes with one head, and drills one with another head. Seven oil holes then are probed at Station 10. Station 11 taps two holes, the block being tumbled at Station 12 to remove chips; 18 vertical holes are tapped at Station 13, while a second head chamfers four side oil holes. Ten vertical holes are tapped at Station 14, while a horizontal head taps four side oil holes. The block is tumbled once again to remove chips.

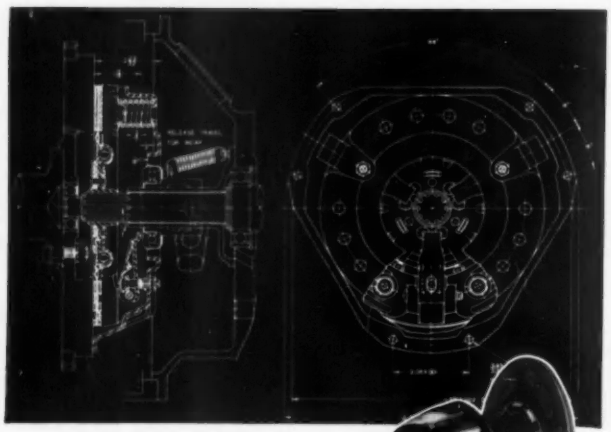
Next in line is still another Footburt transfer machine, this one having 12 stations. Here the block is started with top up and front end leading for holes in the top and banks. Station 2 chamfers eight and rough-counterbores 10 head bolt holes on each bank. Station 3 finish counterbores two head dowel holes on each bank. This is followed by operations on tappet bores. Station 5 chamfers eight tappet bores in each bank. Stations 6 and 8 end-cut-ream four tappet bores each, on each bank. Ten head bolt holes are tappet in each bank at Station 9, while Station 11 finish-reams eight tappet bores in each bank.

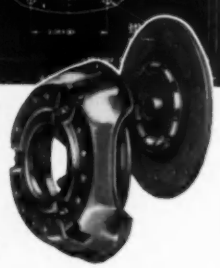
Some miscellaneous operations follow, including installation of welch plugs. The five main bearing caps then are assembled and the fastenings made home by means of a 10-spindle multiple nut runner. The block now moves as a sub-assembly to a group of Ingersoll transfer boring mills.

Here we have a 7-station Ingersoll for rough-boring and face-counterboring in the rear main bearing; drilling two oil seal holes, and milling a clearance at Station 2. Station 3 semi-finish-bores the cam, crank, and starter bores; rough-counterbores the rear main

(*Turn to page* 94, *please*)

ROCKFORD





Design and Stay With the Genuine

ROCKFORD CLUTCHES provide the advantages of heat-treated, hardened and ground steels—flat, non-grab facings—heat dissipation—dirt exclusion—and fine adjustments. Only ROCKFORD provides clutch levers that reduce friction, improve release action and prevent lever throw-out. These wear-resisting, life-lengthening clutch features are essential to designs that must be projected with a thought to uses of tomorrow. ROCKFORD engineers now are working with many companies on their future designs—to provide custom-engineered clutches for long range economy. Their services are available to you.

BW SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

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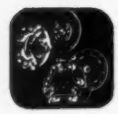
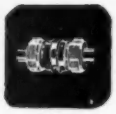
315 Catherine St., Rockford, Ill., U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.



Small Spring Loaded

Heavy Duty Spring Loaded



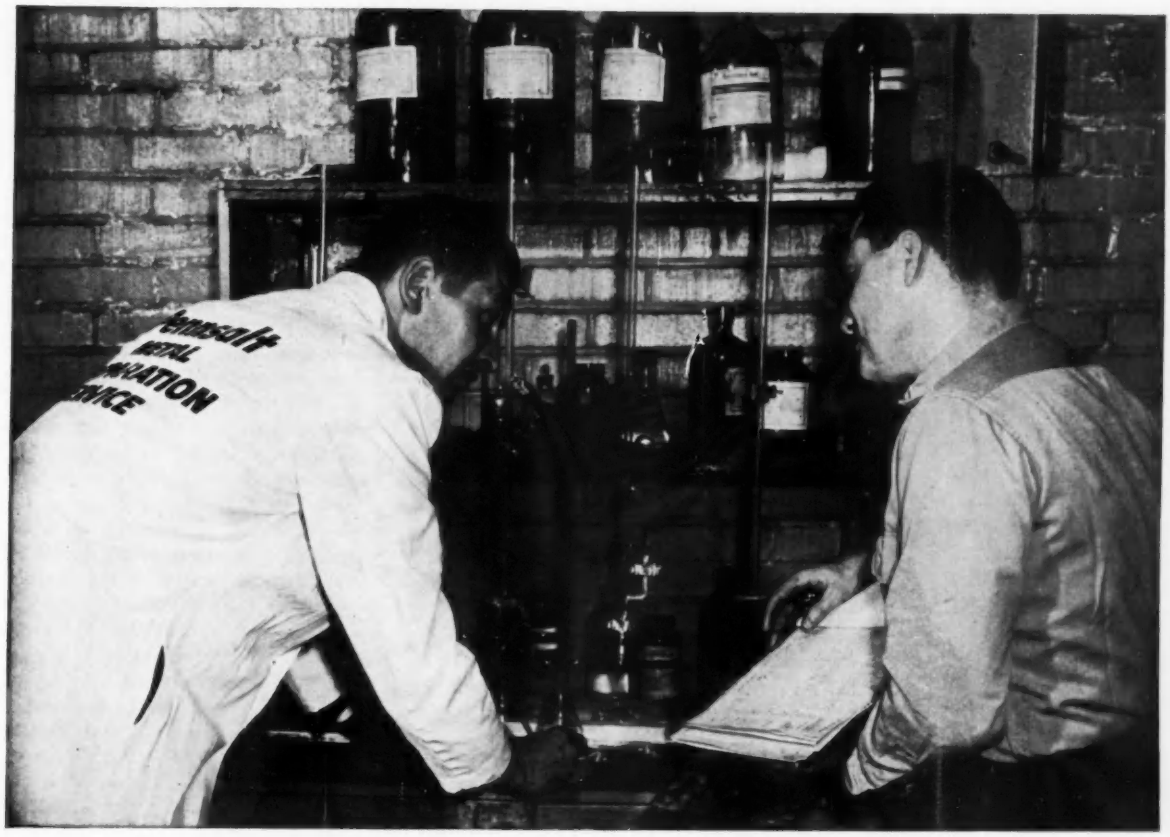
Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

CLUTCHES



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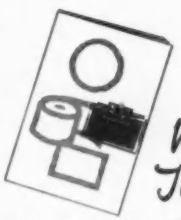
Pennsalt's Metal Preparation Service Plan gives you complete, personalized service by a nation-wide staff of trained specialists. You get periodic surveys of your processes . . . help in modernizing with automatic equipment . . . installation and start-up aid . . . laboratory analyses of your special problems . . . fast emergency service . . . plus other important aids to better finishing.

Service like this . . . exclusive from Pennsalt . . . is another way you profit from Pennsalt's "system approach" to metal surface preparation. Pennsalt supplies a complete line of quality processing compounds, and a plant-proved line of automatic surface treating machines . . . integrates chemicals, machines and service to help you get superior finishing with top economy.



Write Today

for your copy of this booklet on Pennsalt's Metal Preparation Service Plan, or see your Pennsalt representative for more information on Pennsalt service, materials or machines. Write to Dept. 160.

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with OSBORN Power Brushing

Before these boiler tubes can be induction welded—scale and hardened preservative oil must be removed.

This manufacturer does the job simply . . . efficiently with fast, automatic Osborn Power Brushing.

Quality and uniformity of the finished tubes are excellent . . . to help assure strong welds. *Cost is less* than the former blast-cleaning method, and the operation is *cleaner*, too . . . no flying grit.

This is typical of the many new . . . varied—and often unique—metal cleaning and finishing operations being done throughout industry by modern Osborn Power Brushing.

An **O**sborn **B**rushing **A**nalysis—made in your plant now—can *pinpoint new savings* for you, too. Write us for details. *The Osborn Manufacturing Company, Dept. E-81, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

POWER, PAINT AND MAINTENANCE BRUSHES
METAL FINISHING MACHINES . . . AND FINISHING METHODS
FOUNDRY PRODUCTION MACHINERY

Circle 148 on Inquiry Card for more data

Cylinder Blocks

(*Continued from page* 92)

bearing, these bores being finished at Station 4. Station 5 finish-faces and chamfers the No. 3 main bearing and trepans a groove in the rear end of the No. 5 main bearing.

Last major operation is handled in an 11-station Ingersoll transfer machine. The group of five cam bearings are pressed-in at Station 2. Station 3 precision-bores the cam, crank, and upper and lower distributor bores, as well as the counterbore in the rear main, and dowel holes in the rear end of the case. These operations are inspected at Station 4. At Station 5 the block is located on the finished main bearings and thrust face and both ends are finish-milled. Head faces are finish-milled at Station 6. The block is turned and vibrated at Station 7 to dump chips. Bores then are inspected as to size at Station 8 and semi-finish- and finish-precision-bored at Station 9. Top and bottom of cylinder bores are chamfered at Station 10, the block being unloaded at Station 11.

Final operation on the cylinder block is honing of bores. This is done in a multiple station Bernesdril honing machine, equipped with automatic hone sizing attachments. The machine has two working stations, each one equipped with four honing tools, mounted in vertical position. The block enters the first unit for honing one bank, then is transferred to the second unit for honing the other bank.

Honed bores are held to extremely fine tolerances on diameter as well as for roundness and freedom from taper. Some impression of cylinder bore grading may be gained from the piston grades specified for one of the blocks—the V-304. Piston sizes are selected as follows: 3.8750-3.8745 in.; 3.8755-3.8750 in.; 3.8760-3.8755 in.; 3.8765-3.8760 in.; 3.8770-3.8765 in.

The block then is washed and inspected and is ready for transfer to storage and final assembly ■

This is Part I of a two-part article. Part II will appear in an early issue of AUTOMOTIVE INDUSTRIES.

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Summer or winter the car with plenty of Stainless Steel
is easy to clean and keeps its good looks
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No other metal offers the freedom of design and fabrication,
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McLOUTH STEEL CORPORATION, Detroit 17, Michigan

specify

McLOUTH STAINLESS STEEL

HIGH QUALITY SHEET AND STRIP

for automobiles

Circle 149 on Inquiry Card for more data

"Building-Block" Standards for High Production Machine Tools

(*Continued from page* 59)

Wing Base Adapter (Dial Type & Center Column Machines) — The wing base adapter is to be used with round dial type main bases having "T" slots around the periphery. The wing base attaching surface shall be machined to specifications.

Horizontal Angular Adapter — The angular adapter is to be used with single-station or multiple-station machines. It is to be provided in sizes in relation to the wing base. The attaching surfaces shall be machined to specifications established. Angle between the attaching surfaces to be as required for the specific application.

The adapter plate, an acceptable alternate, is to be available in relation to feed unit requirements.

Holes required for securing the adapter plate to the wing base mounting surface shall conform to specifications. Holes for securing feed unit to the adapter plate to be machined to suit feed unit requirements.

Feed Unit-Way Type—This component to be provided in five sizes. Mounting surface dimensions, bolt hole patterns and sizes of the wing base mounting surface, and height from the wing base mounting surface to the top of saddle mounting surface shall be as specified.

Holes required for securing applicable tooling to the saddle mounting surfaces, to be selected by the machine manufacturer, shall be located on the junction line in increments divisible by (3), as established in the specifications.

Vertical Columns (Standard or Integral)—The columns to be provided in five sizes, in relation to the specified feed unit size, shall coincide with feed unit mounting holes. Bolt hole pattern and sizes for mounting feed unit shall be as specified. The standard column is preferred. The integral way type or alternate columns may be used when required for specific operations.

Angular Column—This component to be provided in five sizes, in relation to the specified feed size. Width, length, bolt hole mounting patterns and sizes shall be as specified. Angle between mounting surfaces to be as required for the specific operations.

Adapter—Quill Type Unit; Mounting Bracket—Quill Type Unit — This adapter and mounting bracket, to be used with quill type units, is to be provided in five sizes in relation to the specified wing base.

The adapter width, length, bolt hole mounting pattern and sizes shall be as specified.

The mounting bracket bolt hole attaching pattern and sizes shall be as specified.

The standard dimensions formulated by the Builder-User Working Committee were published March 2, 1959 and submitted, for review, to all builders and users participat-

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Business comes to us only when customer engineering applications require closer adherence to critical specifications (in high volume) than most foundry practices can supply. For we are specialists in precisely measured, closely limited, and constantly verified quality, controlled to extremes.
From assembling the charge to sampling the heat, process control specialists "ride herd" through every hour. And, from shake-out on, control technicians check each single manufacturing operation to the shipping dock.
Through striving constantly to improve castings quality, our volume has multiplied many times in 13 years.
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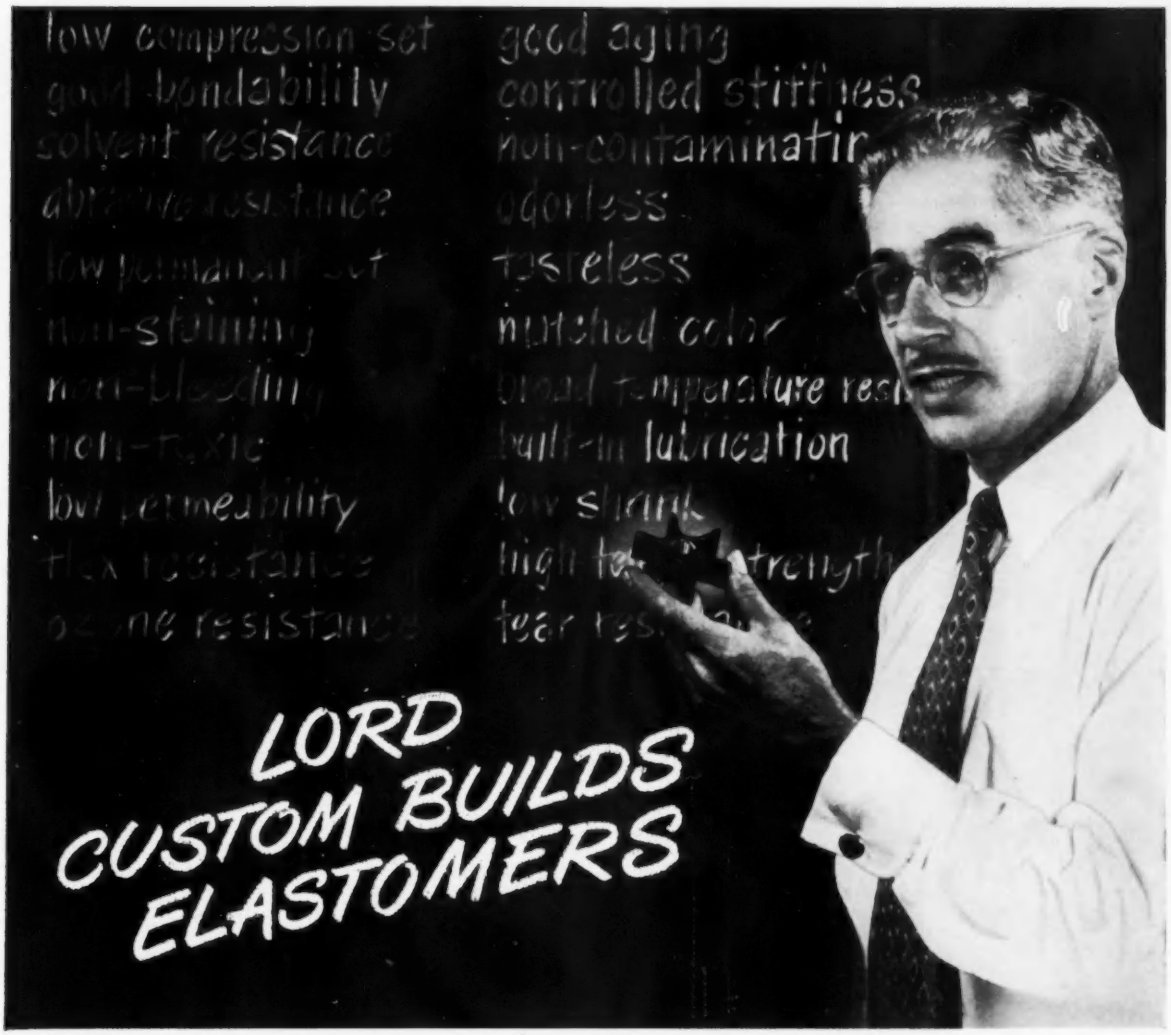
SUPPLIER TO THE AUTOMOTIVE, AIRCRAFT, HYDRAULIC AND SPECIALIZED MACHINE INDUSTRIES.
ENGINEERING CASTINGS, INC.
MARSHALL, MICHIGAN



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KANSAS CITY, MO. · WEstport 1-0138
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NEW YORK, N. Y. · Circle 7-3326
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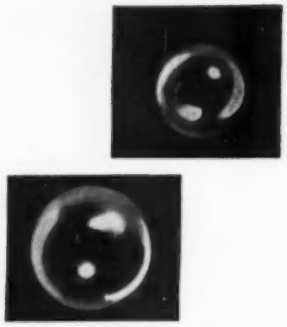
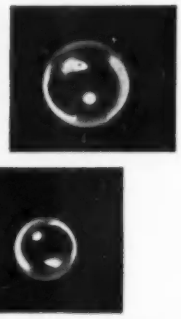


WHEN
IT COMES TO
BALL BEARINGS . . .



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BCA BALL BEARINGS
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DIVISION OF
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ing in the program for the standardization of production machine tools. The dimensional standards, are consistent with the consensus of comments received from the Builder and User Group. The Builder-User Working Committee consisted of representatives from:

BUILDERS

Buhr Machine Tool Co.
Cincinnati Milling Machine Co.
The Cross Co.
Ex-Cell-O Corp.
Greenlee Brothers and Co.
Heald Co.
Kearney and Trecker Corp.
Michigan Special Machine Co.
National Automatic Tool Co., Inc.
Rehnberg - Jacobson Manufacturing Co.
Snyder Corp.
Sundstrand Machine Tool Co.

USERS

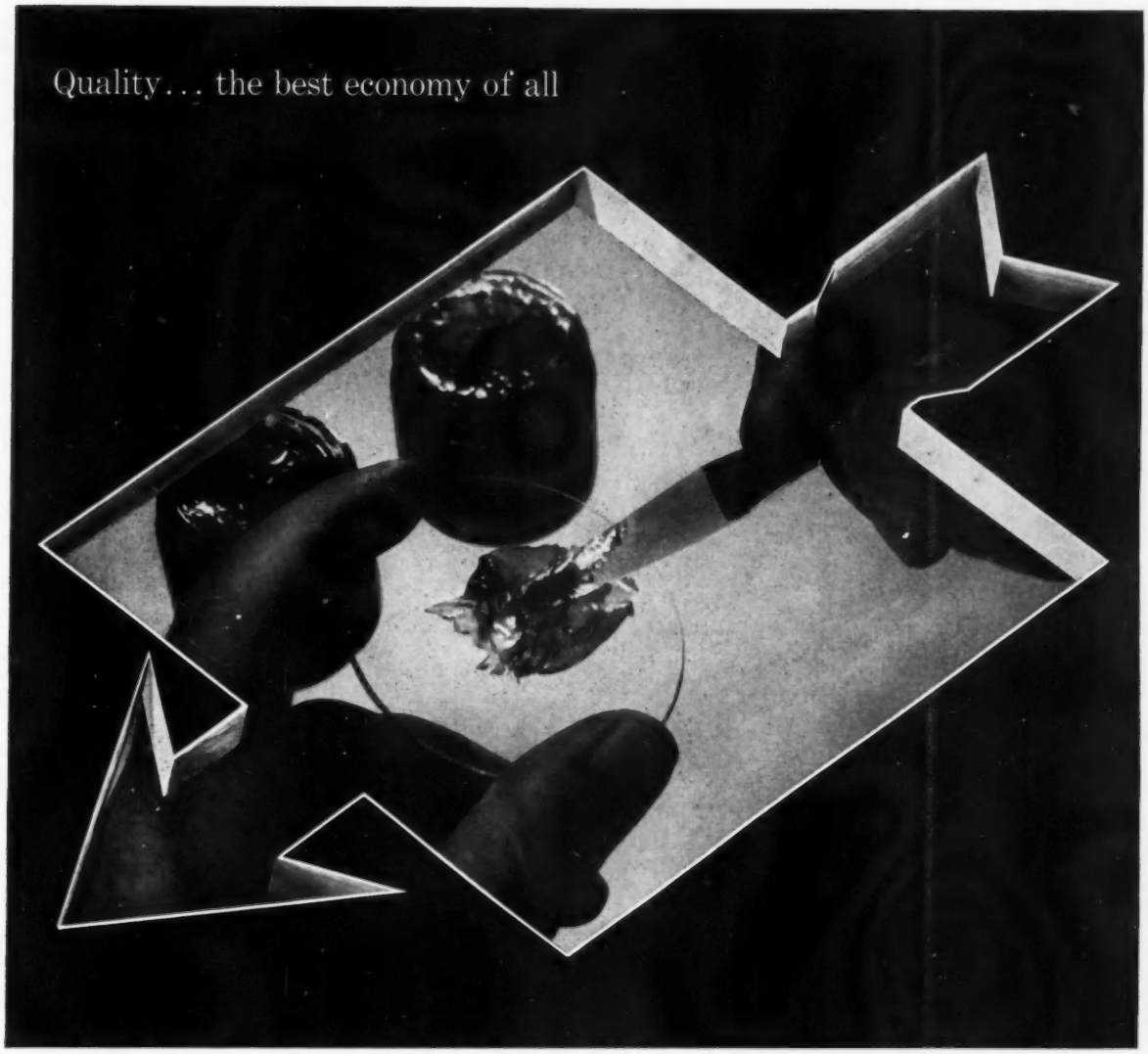
Chrysler Corp.
Ford Motor Co.
General Motors Corp.
International Harvester Co.

The committee was appointed by the builders represented at meetings held at the Rackham Building in Detroit on January 6, 7, 8 and 9, 1959. These meetings were attended by the following machine tool companies:

Baker Brothers Inc.
Baldwin-Lima-Hamilton Corp.
Barnes Drill Co.
W. F. and John Barnes Co.
Baush Machine Tool Co.
Buhr Machine Tool Co.
The Cross Co.
Cincinnati Milling Machine Co.
Davis-Thompson Co.
Ex-Cell-O Corp.
Foote-Burt Co.
Greenlee Brothers and Co.
Ingersoll Milling Machine Co.
Heald Machine Co.
Kearney and Trecker Corp.
Kingsbury Machine Tool Corp.
Krueger-Barnes Corp.
F. Joseph Lamb Co.
LeMaire Tool and Manufacturing Co.
Michigan Special Machine Co.
Motch and Merryweather Machinery Co.
National Automatic Tool Co., Inc.
Rehnberg - Jacobson Manufacturing Co.
Snyder Corp.
Special Machine and Engineering, Inc.
Sundstrand Machine Tool Co.

(*Turn to page* 100, *please*)

Circle 152 on Inquiry Card for more data



It's a multipurpose grease . . . but *how* multipurpose?

You can't "feel" the answer. Any "multipurpose" grease you buy is a compromise. Lubrication engineers say it *can't possibly be* the best lubricant both for high speeds and low loads . . . and for low speeds and heavy loads. It's *got to be* somewhere in between, so that it can do both jobs fairly well.

What you should do is decide on *which* multipurpose grease is best for you. This is a decision for an expert team—you and your Sun representative—because you have to consider many variables.

We feel, justifiably, that one of Sun's Prestige Multipurpose Greases is designed with that wide range of applications you're looking for. They last longer under pressure, water, heat, and other abuses. They bear investigation. To start enjoying the real economy of quality, call that Sun man today—or write direct to SUN OIL COMPANY, *Philadelphia 3, Pa. Dept. AA-8, In Canada: Sun Oil Company Limited, Toronto and Montreal.*

SUNOCO

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

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(*Continued from page* 98)

Other users contributing to the finalization of these standards are:

Allis Chalmers Corp.
American Motors Corp.
Bendix Aviation Corp.
Caterpillar Tractor Co.
Cummins Engine Co., Inc.
Dana Corp.
General Electric Co.
International Business Machines Corp.
Vickers, Inc.
Waukesha Motors
White Motor Co.

LETTERS *to the* Editor

(*Continued from page* 13)

parts and small hand tools with some American manufacturers. I have available a booklet "Opportunities for Industrial Collaboration in India," in which I have tried to explain the conditions that exist in our country and the various forms under which a collaboration could be made. I would be glad to hear from any interested U. S. manufacturers.

P. Sharon Gupta
P. Sharon & Co.
Post Box 1145
Kashmerere Gate
Delhi 6, India

ADHESIVE BONDING

We were quite impressed with the fine job done on the two-part article "Cutting Costs with Adhesive Bonding" in the July 1 and July 15 issues of AUTOMOTIVE INDUSTRIES. As a matter of fact, this is one of the best articles on the subject which we have seen.

Jerome W. Brush, Jr.
Manager
Adhesives Dept.
Raybestos-Manhattan, Inc.
Bridgeport 2, Conn.

The second section of the article on "Cutting Costs with Adhesive Bonding" in the July 15 issue of AUTOMOTIVE INDUSTRIES was even more informative and comprehensive than the first. You are, indeed, to be congratulated on doing such an easily readable job on so complex a subject.

Bernard Gould
Manager
Market Development
Rubber & Asbestos Corp.
225 Belleville Ave.
Bloomfield, N. J.

BRAKE BOOSTERS

In reference to the letter from Mr. J. G. MacDonald of Dominion Road Machinery, Ltd., Goderich, Canada (see Letters to the Editor, AI, July 1), we would advise that we are the British manufacturers and sole licensees for the Baldwin F. B. hydraulic brake system for the United Kingdom and the British Commonwealth (including Canada).

We have supplied this unit to Aston Martin Lagonda, Ltd., for the Mk. III car. In addition, we have equipped a number of heavy vehicles such as the seven-ton Dennis Fire Engine with excellent results.

J. duMont
Director
M.E.C. Transmissions, Ltd.
31-32 Alfred Place
London W.C. 1
England

27 Volt DC shunt wound aircraft motor qualified to specification MIL-M-8609A (ASG) for small high speed pumps. Frame 1²⁵/₃₂ x 1⅛

The door to your motor department . . .

Two-stage helical gearmotor with crank on output shaft to operate circuit breaker. Frame 2⅞ x 1½

⅜ Horsepower motor with two-stage fan, Underwriters' labeled for explosion-proof vacuum cleaners.

Differential planetary gear train allows for unusually compact design in this miniature gearmotor for business machines. Frame 1⅝ x ¹⁵/₁₆

We work so closely with customers that many consider our facilities a part of their own operations.

In addition to direct field contact through District Engineers, customers are welcome in our plant to consult with various parts of our organization.

Close cooperation of our staff with your purchasing and engineering departments can mean improved dependability of your motor-driven product, reduced weight, greater compactness and delivery of production quantities on time and and at the lowest possible cost.

NEW!
8-page Folder describes these and other Lamb Electric motors. Send for your copy.

THE LAMB ELECTRIC CO. • KENT, OHIO
A Division of American Machine and Metals, Inc.

Lamb Electric

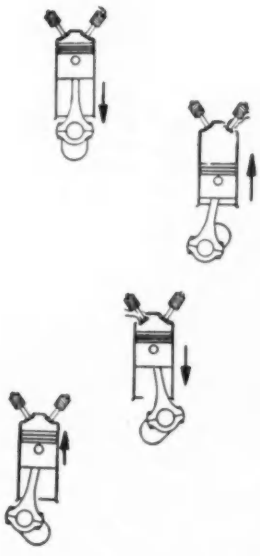
In Canada: Lamb Electric
Division of Sangamo Company Ltd.—Leaside, Ontario

Circle 154 on Inquiry Card for more data

Why MORE MILES of *factory-engineered timing*

are built into LINK-BELT Timing Chain

Wear compensation joint maintains peak performance longer



HERE's why factory-fine valve timing lasts longer with Link-Belt Timing Chain. Adding to the benefits of segmental bushings — which automatically provide snug joints and reduce "slap" on the non-load side — Link-Belt's built-in check in joints allows forward articulation for sprocket engagement but reduces back-bend and whip to a minimum.

In 45 years of timing chain application experience, Link-Belt has developed many "firsts" — including the space-saving $\frac{1}{16}$-in. used by major auto makers since 1949. For full details including data you need for layout work—write for Book 2065.

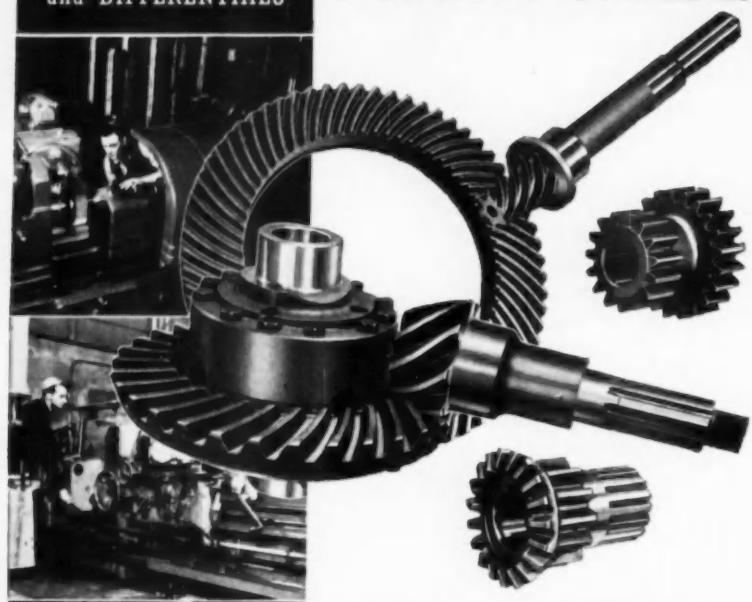
LINK-BELT

TIMING CHAIN AND SPROCKETS

LINK-BELT COMPANY: 220 South Belmont Ave., Indianapolis 6, Ind.

GEARS
and DIFFERENTIALS

made to Your order by
FAIRFIELD



A Plus Value
IN ANY PRODUCT!

Simple arithmetic explains why, TODAY, many of America's leading machine makers no longer undertake to solve the problems involved in production of gears, differentials, and specially designed gear parts. For them, FAIRFIELD IS THE ANSWER!

Every facility is available at Fairfield — latest, cost-cutting, ultra-modern metal-working and heat treating equipment, kept busy by volume production, *plus* expert engineering counsel. This makes for economy and efficiency that can benefit YOU.

Check with Fairfield NOW on your gear production schedules. As one of the nation's largest independent producers, Fairfield can usually give you quickest service available and handle any production requirement. *Become a Fairfield customer; it pays!* CALL OR WRITE.

FAIRFIELD
MANUFACTURING CO.
2303 South Concord Rd. Lafayette, Indiana
TELEPHONE: SHerwood 2-7353

Gears and Differentials For FINE GEARS *Made to Order for:*

TRACTORS • HEAVY DUTY TRUCKS • AGRICULTURAL MACHINERY • POWER SHOVELS AND CRANES
MINING MACHINES • ROAD GRADERS • BUSES • STREET SWEEPERS • INDUSTRIAL LIFT TRUCKS

SHORTIES

Truck transportation now employs 7.4 million persons, or one out of every ten employed men and women in the U. S.

●

In 1958, 11.2 million private and publicly owned trucks were in use on U. S. streets and highways —a new high. Trucks account for nearly 17 per cent of total U. S. motor vehicle registrations.

●

Trucks haul 1.6 billion tons of freight a year—more than any other type of carrier.

●

Steelmaking furnaces in the U. S. poured a record 64,278,569 net tons of ingots and steel for castings during the first half of 1959, compared with 37,752,487 tons for the like period last year.

●

Steel output for the first half of 1959 was 154.8 in terms of the basic index of average production during the period 1947-49. This compared with 90.9 in the same period a year ago.

●

Steel output during the first half of 1959 averaged 87.8 per cent of capacity, based on January 1959 capacity rating of 147,633,670 net tons of raw steel.

●

The U. S. will need about $171 billion in capital investment to develop water resources by 1975 in order to keep abreast of population growth, industrial expansion, and higher living standards.

●

Investment in development of water resources is estimated to have grown from about $415 per capita in 1900 to $1028 in 1958 and is expected to increase to $1348 by 1975.

●

Fatigue tests of a turbojet compressor blade includes 100 million vibrations to determine the vitality of the metal.

3000 POUNDS OF OLIN ALUMINUM ON THE MOVE! Marmon-Herrington's 115 new, Brazil-bound buses will have outer sheets, side panels, pressed sash panels, ventilating ducts and ceiling panels of Olin Aluminum. Alloys are 5052-0 and 3003-0.

One hundred fifteen trolley buses—largest order of its kind ever produced for export—will have bodies of Olin Aluminum exclusively. Built by Marmon-Herrington Company, Inc. of Indianapolis, the 49-passenger coaches are headed for service in tropical Brazil.

In transportation, as in other principal metals markets, Olin Aluminum now ranks as a major source. We supply aluminum tailor-made to the most exacting standards. For primary aluminum, for sheet products, for extrusions, rod and bar . . . call on—**depend** on—Olin Aluminum.

OLIN ALUMINUM

OLIN MATHIESON • METALS DIVISION • 400 PARK AVE. • NEW YORK

To PROFIT MOST from precise

CUSTOM-MADE RUBBER
PARTS • SEALS • COMPONENTS

Go Goshen

Exclusive Techniques in
COMPOUNDING
MOLDING
LATHE CUTTING
METAL BONDING

If the seal or part, or component you need can best serve by being made of natural, synthetic or silicone . . . count on Goshen. Exclusive techniques developed here at GRC are available for fabricating to meet your strictest specifications, and for advance testing under many types of near-field conditions. Let us know your requirements.

Send for Literature

☐ TETRASEALS ☐ GORLUBE (Low Friction Treatment)
☐ O-RINGS ☐ GROMMETS

Goshen Rubber Co., INC.
2789 S. TENTH ST. GOSHEN, INDIANA

ON OUR WASHINGTON WIRE

Moscow is making it clear that it has high hopes of building up U. S.-U.S.S.R. trade by the end of this year.

At the present time, U.S.S.R. exports to the United States are chiefly furs, caviar, and hides. The volume of finished goods is low. The Soviets want to increase trade substantially, particularly in the sale of metals and machinery.

Main difficulty in opening up a large volume of trade between the U. S. and the U.S.S.R. is that the Reds want to buy—on credit—far more from us than we can possibly buy from them. (The U. S. economy can only absorb so much caviar.) This would result in a lop-sided credit balance, with dim prospects of getting paid, facing U. S. exporters.

Besides the currency exchange question, U. S. officials are not anxious for military security reasons—to see strategic goods such as machine tools and electronic equipment exported to the U.S.S.R.

Materials remain a limiting factor in U. S. weapons systems development. Defense Dept. is trying to remove this limitation by assigning research for major improvements in structural and other materials.

One project in this field is for development of super-strength antiradiation materials. This project, PONTUS, also takes in thermoelectric devices needed for space probe satellites.

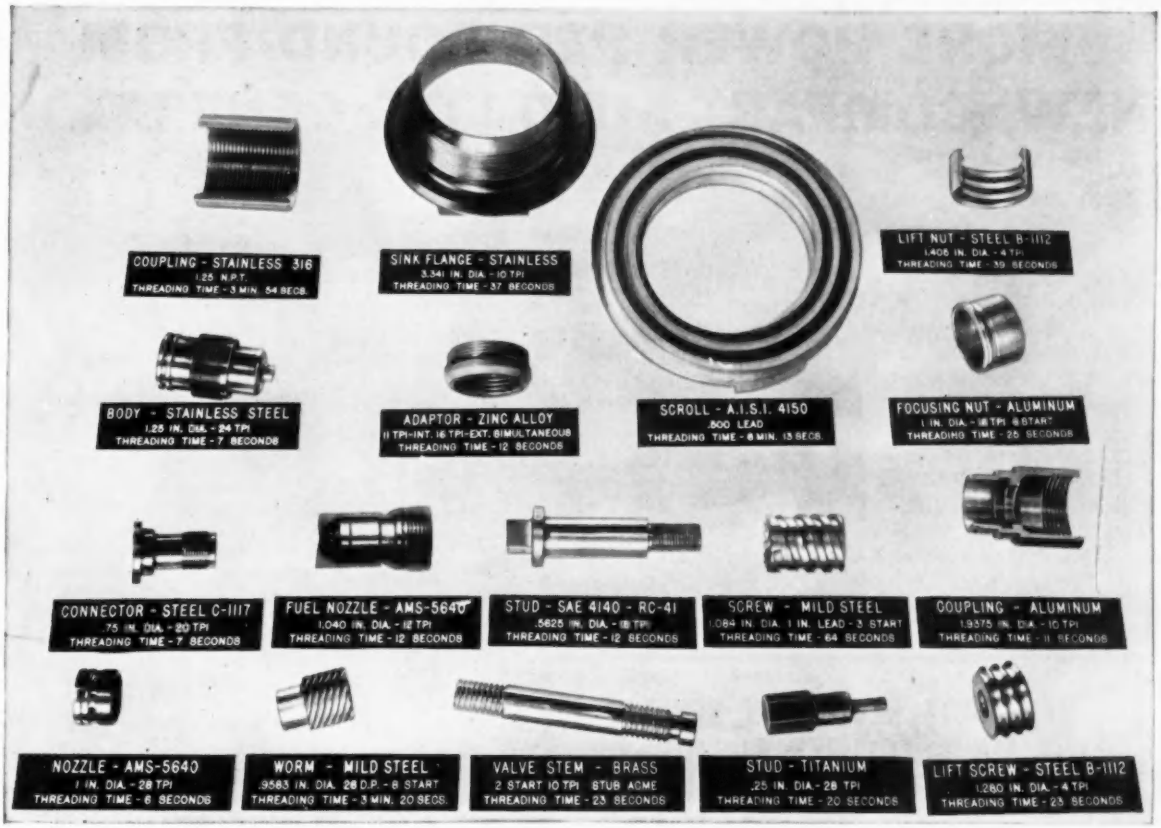
Rise in U.S.S.R. foreign aid, now running at more than $1 billion a year, alarms U. S. State Dept. planners. Although this total is less than one-third of what the U. S. spends on foreign assistance, State Dept. insists we must give away more in order to stay ahead.

U. S. Treasury's giving closest study to industry views on depreciation. T-men are now sampling a cross-section of owners of capital goods. What the questionnaires reveal will form base for Administration view to congressional taxwriters in November concerning the depreciation problem.

The current business boom is pushing Government revenues up much higher than forecast. Some experts expect the Government to go into the black by between $2 and $5 billion in the next fiscal year.

Circle 158 on Inquiry Card for more data

Start saving money right now on threading jobs like these with...


COUPLING - STAINLESS 316
1.25 N.P.T.
THREADING TIME - 3 MIN. 54 SECS.
SINK FLANGE - STAINLESS
3.341 IN. DIA. - 10 TPI
THREADING TIME - 37 SECONDS
LIFT NUT - STEEL B-1112
1.406 IN. DIA. - 4 TPI
THREADING TIME - 39 SECONDS
BODY - STAINLESS STEEL
1.25 IN. DIA. - 24 TPI
THREADING TIME - 7 SECONDS
ADAPTOR - ZINC ALLOY
11 TPI-INT. 16 TPI-EXT. SIMULTANEOUS
THREADING TIME - 12 SECONDS
SCROLL - A.I.S.I. 4150
.800 LEAD
THREADING TIME - 8 MIN. 13 SECS.
FOCUSING NUT - ALUMINUM
1 IN. DIA. - 16 TPI 6 START
THREADING TIME - 25 SECONDS
CONNECTOR - STEEL C-1117
.75 IN. DIA. - 20 TPI
THREADING TIME - 7 SECONDS
FUEL NOZZLE - AMS-5640
1.040 IN. DIA. - 12 TPI
THREADING TIME - 12 SECONDS
STUD - SAE 4140 - RC-41
.5625 IN. DIA. - 18 TPI
THREADING TIME - 12 SECONDS
SCREW - MILD STEEL
.1084 IN. DIA. 1 IN. LEAD - 3 START
THREADING TIME - 64 SECONDS
COUPLING - ALUMINUM
1.9375 IN. DIA. - 10 TPI
THREADING TIME - 11 SECONDS
NOZZLE - AMS-5640
1 IN. DIA. - 28 TPI
THREADING TIME - 8 SECONDS
WORM - MILD STEEL
.9583 IN. DIA. 28 D.P. - 8 START
THREADING TIME - 3 MIN. 20 SECS.
VALVE STEM - BRASS
2 START 10 TPI STUB ACME
THREADING TIME - 23 SECONDS
STUD - TITANIUM
.25 IN. DIA. - 28 TPI
THREADING TIME - 20 SECONDS
LIFT SCREW - STEEL B-1112
1.280 IN. DIA. - 4 TPI
THREADING TIME - 23 SECONDS

CRI-DAN SINGLE-POINT THREADING LATHES

...cut costs with simple single-point carbide tools. They're easily resharpened or replaced. They eliminate expensive upkeep of thread milling cutters or thread grinding wheels.

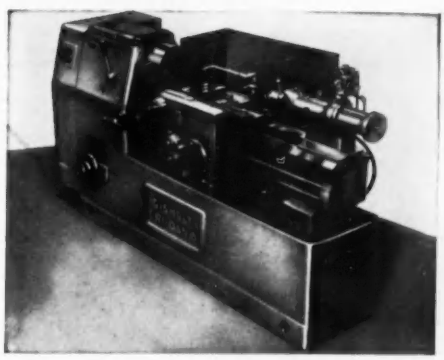
...assure extremely accurate lead and thread form and exceptional finish with low-cost carbide tools on materials that don't allow economical threading by other methods.

...handle any material from titanium or toughest alloy steels to brass and other non-ferrous metals with a wide selection of spindle speeds and feeds to meet all job requirements.

...set up fast to produce single- or multiple-start, coarse or fine, left- or right-hand threads, parallel or tapered with metric or inch pitches—thread up to shoulders on all types of internal and external operations.

...cut costs from start to finish with CRI-DAN's speed, versatility and economy.

Why put off the savings the CRI-DAN method can bring you *right now?* Ask your Gisholt Representative for complete details. Or write us for literature or cost estimates on your particular work.



Two models are available. The smaller Model B (shown) offers extreme flexibility with spindle speeds of from 154 to 2808 r.p.m.; 3' capacity between centers and 15½" swing over bed. Rugged saddle supports fast-acting threading slide, easily positioned along bed. Complete change-over from job to job can be made in 15 minutes.

Investigate Gisholt's Extended Payment and Leasing Plans

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

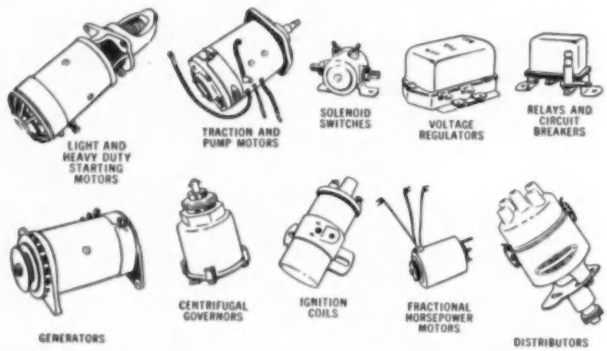
Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • *Factory-Rebuilt Machines with New-Machine Guarantee*

NOW...FROM AUTO-LITE

MORE POWER PER POUND FROM NEW, COMPACT AUTO-LITE GENERATOR

NEW COST REDUCTION SERVICE FOR MANUFACTURER CUSTOMERS

Programs that include design, engineering, methods, automation and manufacturing are all contributing to the important new cost reduction service of the Electrical Products Group of Auto-Lite. Included are greatly expanded research and engineering activities, facilities for field training and service, and District Managers prepared to assist customers and prospects in their drive for lower costs.



This new Auto-Lite generator is designed for use wherever dependability and efficiency are required: for marine, fleet, automotive and light and heavy commercial industrial applications. Quality engineering means outstanding performance. But let the features tell the story . . .

1. Insulation . . . good for 20 years at 105°C.
2. High-load-capacity AFBMA-approved ball bearings and sintered bronze sleeve bearings.
3. Thermosetting phenolic varnish insulates the armature; retains its strength under great mechanical stress.
4. Brushes balanced for optimum quietness, performance, and long life.
5. Commutator segment insulation is undercut mica . . . total commutator runout held to .0005 in.
6. Armatures are precision built to virtually eliminate vibration.
7. Silver-bearing copper is used to retain physical strength in the commutator even at high temperatures.

Some models are available in the new, lighter Step Frame design. For complete details use the coupon at right.

AUTO-LITE®

ELECTRICAL PRODUCTS GROUP

THE ELECTRIC AUTO-LITE COMPANY, TOLEDO 1, OHIO

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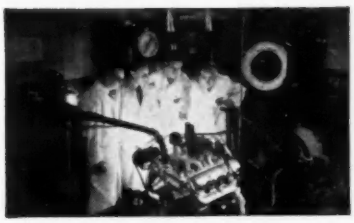
GREATLY EXPANDED RESEARCH AND ENGINEERING FACILITIES ASSIST AUTO-LITE CUSTOMERS



In 19 modern laboratories hundreds of graduate engineers and scientists, assisted by skilled laboratory technicians and draftsmen, are engaged in special projects for the military and industry.

Each individual laboratory specializes in its own area of research and engineering. Any two or more laboratories can be co-ordinated under the Director of Research in a team effort to approach a particular problem or series of problems.

Attitude of Inquiry

By maintaining a practical attitude of inquiry, Auto-Lite engineering is made vital and anticipates the needs of the many industries we serve.

Low voltage ignition, coaxial starters, cermets, ceramics, transistorized ignition have all been under development in the Auto-Lite laboratories in recent years.

How you can take advantage of this service

As a part of the new Auto-Lite Cost Reduction Service, the Electrical Products Group District Managers are at your service. They can tell you how Auto-Lite can make available to you the skills and know-how of its 19 engineering and research laboratories, its manufacturing facilities, and its world-wide service organization. They can help you with your cost reduction and product improvement programs.

THE ELECTRIC AUTO-LITE COMPANY
ELECTRICAL PRODUCTS GROUP • TOLEDO 1, OHIO

Please send me further information on . . .

- ☐ Distributors
- ☐ Pump & Traction Motors
- ☐ FHP DC Motors
- ☐ Generators
- ☐ Relays, Solenoids, Governor Switches
- ☐ Starting Motors
- ☐ Voltage Regulators
- ☐ Oil-Filled Coils

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Company_____ Position_____

Address_____

City & State_____ AI

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What the Army Needs in Engines

(*Continued from page* 57)

the loss of a set of ignition points is as serious as a thrown rod. Both failures put vehicles out of action.

We are aware that accessory manfacturers are expending great numbers of research and development dollars to improve their products. We are not sure that these expenditures will help us. Accessories are becoming smaller, lighter, cheaper and more compatible with the demands of the styling department. They may be becoming more durable and reliable. We certainly hope so because these components under use today do not fill our needs. Even when modified they cannot resist the rigors of temperature, dust and water emersion required by military service.

Summary

At present Ordnance has three objectives concerning durability and reliability of engines. These are:

1. Increase protection of service vehicle engines to permit full use of the engine's durability potential.
2. Improve service vehicle's reliability by providing superior accessory and subcomponent items.
3. Assure that development vehicles utilize the optimum engines in conjunction with advanced protection techniques and superior ancillary items.

To achieve these goals Ordnance must have the help of industry. Some of the ways in which assistance can be rendered are:

1. By seeking to understand the nature of the military environment and by recommending components suited therefore.
2. By making early release of development information so that military vehicle planning can incorporate components of the proper time frame.
3. By assisting the military in the collection of field data. Protection and improvement of components is a joint military-producer responsibility.
4. By cooperating with the military in installation as well as selection of components.
5. By offering assistance on any problems relating to the operation of military engines, whether or not they are directly related to the engine.

In discussions such as this it is customary to exhort the reader to perform great deeds. I do not think that any such effort is required. The provision of adequate durability and reliability to military ground equipment is not a problem of the same order of magnitude as the launching of an earth satellite. Rather it will require sound engineering, a spirit of selflessness on the part of both the producer and the user and a willingness to understand the problems of either. We in the military are hard taskmasters. We know that our requirements are difficult to meet. Still we hope that they will appear to industry as challenges, the answers to which will benefit industry, the Army and the Nation.

The foregoing article is from a paper presented by the author at the annual meeting of the American Ordnance Association Combat and Tactical Vehicle Division held in Detroit May 14 and 15. ■

V-6 and V-12 Engine for New GMC Trucks

(*Continued from page* 65)

component interchangeability. Cylinder heads are interchangeable to the extent already noted. Valve covers, connecting rods, main bearing caps, main and con rod bearings, and all types of gaskets are interchangeable. Pistons too are interchangeable to the extent noted earlier. Altogether the V-6 engines have more than 70 parts in common; while both V-6's and the V-12 have over 50 parts in common.

It is noteworthy that three different types of camshaft drives are found on these engines. Silent link chain drive is used on the Series 305A; roller chain is used on Series 305 B & C as well as the 351; gear drive is employed on Series 401 and 702. ■

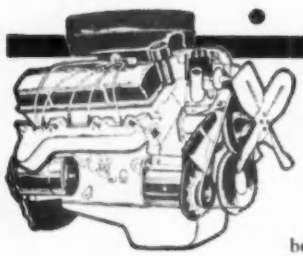
Marine Inboard Engine Field

(*Continued from page* 68)

the industry," and it also has a newly expanded nation-wide "eight-hour" service system on engine parts and replacement service and complete engines. In 1959 Chrysler introduced its Sea-V, 177-hp V-8 which filled in a horsepower range not previously available in the Chrysler marine line. With another new engine announcement expected soon, Chrysler has available plant facilities for additional production expansion, it was stated.

In the total field of recreational boating in the United States 774,000 inboard gasoline and Diesel engines were in use in 1958, according to estimates made at the time of the last Motor Boat Show. Of these, 24,500 were produced in 1958, made up of 3500 Diesel and 21,000 gasoline engines. There were 5,525,000 outboard engines in use, including an estimated 545,000 sold in 1958. There were an estimated 7,330,000 recreational craft in use on U. S. Waterways, with $2,085,000,000 spent during the calendar year for equipment and operation. At least 20 major marinas in various parts of the country opened their slips for the first time last spring according to the National Association of Engine and Boat Manufacturers. In 1958, according to a survey made for NAEBM, 1,250,000 applicants for slips and moorings throughout the United States were turned away for lack of space. Typical large scale marinas are at Long Beach and at Playa Del Rey, Calif., and these two facilities alone will handle 8000 boats. To supply more adequate total information concerning operating and licensed pleasure-boat inboard engine facts, the United States Coast Guard will publish totals on the number of engines by type, in 1960. The first totals should be available late in 1960. ■

JOHNSON *tappets*



**for all engine applications*

All of the engineering and manufacturing effort at Johnson Products goes into producing a better tappet. Continual experimentation and exacting quality control make JOHNSON TAPPETS worthy of your consideration. Only proven materials, covering a range of hardenable iron, steel, and chilled iron of various alloys, are used in JOHNSON TAPPETS. These tappets are successfully used in jobs ranging from light duty to the most severe, punishing applications. Serving all industry that employs internal combustion engines.

Johnson TAPPETS

"tappets are our business"

JOHNSON JP PRODUCTS

MUSKEGON, inc. MICHIGAN

Balancing the V-Six GMC Truck Engine

(*Continued from page* 69)

In this configuration the engine was so mounted that the air springs would flex and deflect freely under engine movement. The engine was operated at a wide range of speeds and with air springs inflated at a variety of pressures. This was done to make sure that the results would reflect the most adverse combination of conditions. All defections were measured and recorded by means of an electronic displacement gage.

The net result of this investigation was to register a maximum displacement of 0.002 in. between the extreme ends of the engine. This compares with the value of 0.0014 in. spelled out by the computer. The correlation was so good that it reinforced the original decision to ignore the built-in secondary couple entirely.

Thus the GMC V-6 can be considered as entirely normal and smooth in operation under all practical operating conditions. ■

New Holley '59 Carburetors can be serviced in minutes— WHILE ON THE ENGINE!

Many 1959 automobiles and trucks will be equipped with newly designed Holley two and four barrel carburetors that have a special needle and seat assembly which makes carburetor service a matter of minutes.

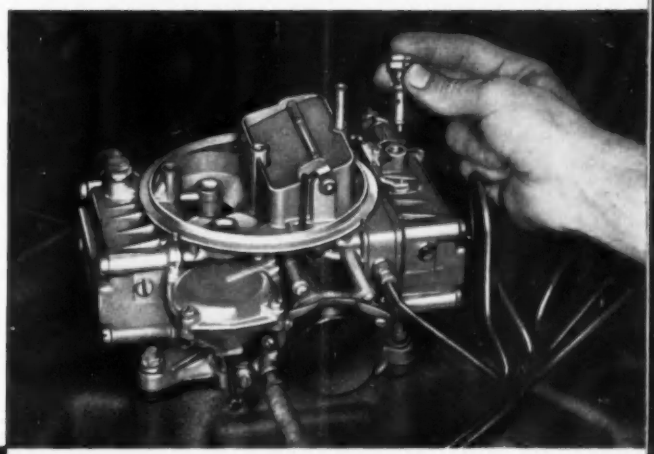
All carburetor minor repair—90% of carburetor service requirements under 30,000 miles—can be completed in the time it takes to remove and replace a single spark plug; and, without removing the carburetor from the engine.

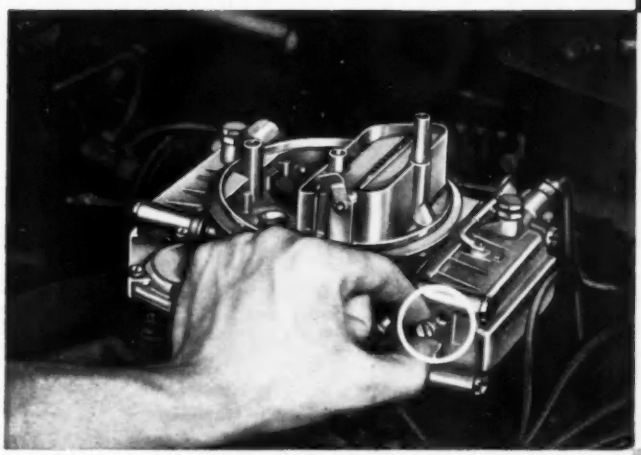
These Holley 1959 models will substantially reduce customer service complaints and will make minor repair work more profitable and more accurate for the service man. With just the four simple steps shown on this page service men can:

1. Purge the carburetor of dirt and foreign matter.
2. Accurately adjust the fuel level in the bowl.
3. Replace or adjust the fuel inlet needle and seat.

These new 1959 carburetors are another example of Holley's continuing leadership in the design and engineering of fuel and ignition equipment.

1 *With ignition off, remove lower bowl screw farthest from fuel inlet. Allow all gasoline to drain, purging the carburetor of dirt and sludge.*

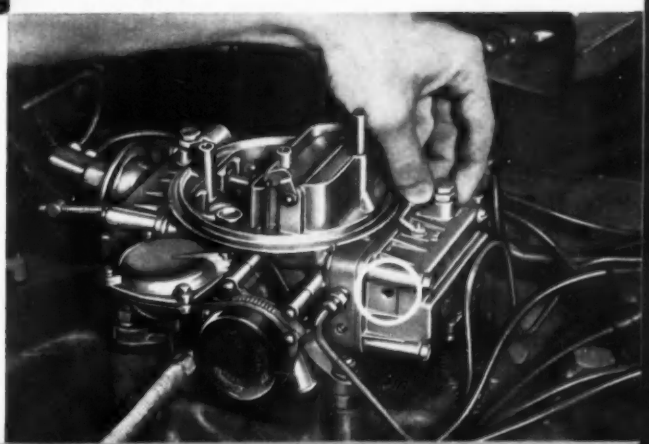




2 *Remove fuel needle and seat and examine for wear and general condition. Replacement can be made at low cost although there should be no evidence of wear until after 20,000 miles.*

3 *With engine running, remove sight plug from carburetor bowl opposite fuel inlet. If fuel level is too high, excessive fuel will drain through sight plug opening. For proper operation, fuel level should be on line with threads at bottom of sight port.*

4 *Loosen top lock nut on needle and seat assembly and adjust with lower nut until float maintains fuel at desired level. Tighten lock nut and minor repair is completed.*



HOLLEY Carburetor Co.

For more than half-a-century — original equipment manufacturers for the automotive industry

11955 E. NINE MILE ROAD • WARREN, MICHIGAN

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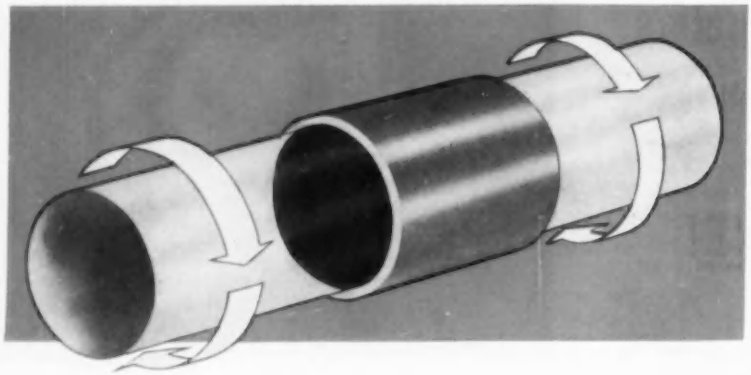

NEW GLACIER DU DRY BEARINGS

allow sliding speeds 5 times greater than other dry bearings

DU's excellent thermal conductivity dissipates heat generated through sliding friction. Under low load conditions, for instance, applications for DU are on record up to 50,000 rpm.

Ideal on high load, low speed combinations, too. DU eliminates slip-stick where coefficient of friction is as low as .04. DU is a patented composite material consisting of a steel-porous-bronze interlayer impregnated with a lead-filled TFE* fluorocarbon resin. Withstands temperatures from −328°F to +536°F; has compressive strength of 51,000 p. s. i.

Apply DU to appliances, automobiles, aircraft, machinery, office equipment. Standard bushings and thrust washers stocked for $\frac{3}{8}$″ to 2″ shafts; strip available for special fabrication. Find out more from your bearing manufacturer, or write for engineering Catalog DU-458.

SPECIAL PRODUCTS DEPT.
UNITED STATES GASKET COMPANY,
Camden 1, New Jersey

*Teflon, DuPont Trademark
Fluon, I.C.I. Trademark

THE GARLOCK PACKING COMPANY
Palmyra, N.Y.

United States Gasket

Plastics Division of GARLOCK

MACHINERY NEWS

(Continued from page 88)

in AI for July 1.)

By comparison, the May, 1959, total for both types of machines was $48.7 million—while in June, 1958, it was $32.1 million.

Net new orders for first half of 1959 totaled $307.2 million—up 71 per cent over last year's equivalent-period figure of $179.75 million.

Shipments in June amounted to $52.75 million—up over May's $41 million, as well as June, 1958's $45.5 million.

During the first six months of this year, shipments totaled $251.85 million—down 18 per cent from last year's first half shipments of $306.5 million, but up 18 per cent above second half, 1958, shipments of $213.4 million.

Ludlow King, executive vice-president of the National Machine Tool Builders' Association, in transmitting these latest operating figures, made this forecast: "Judging from presently known plans and conditions, it is estimated that both new orders and shipments in the last half of 1959 will exceed those of the first half."

Tax Depreciation Problem Receiving Attention

The drafting of a revised and "more realistic" tax depreciation law appears to be closer to reality. In Washington, two recent and separate actions indicate that both the Congress and the U. S. Treasury recognize the deficiencies of existing depreciation laws.

While firm relief is still many months away, the encouraging news at this time is that the Government has taken concrete steps to reconcile the serious restrictions imposed on both producers and users of capital equipment by outdated depreciation laws.

The two Federal actions that now indicate eventual relief are these:

(1) The U. S. Treasury, after much prodding by industry, is now polling selected U. S. machinery users to learn their views on depreciation. The responses will guide the Treasury in presenting

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Circle 165 on Inquiry Card for more data

Education in High Gear

Knowledge is the destination of this vehicle — the world's first Mobile Laboratory for Automotive Research and Education.

J&L stainless steel is used exclusively for exterior and interior components to help assure long, useful life. Part of that life will be devoted to gaining a better understanding of how stainless steel combats corrosion, provides greater structural strength, reduces weight, improves performance.

The high stength and durability of stainless steel can provide greater design freedom, more economical production and longer service life for all functional automotive components.

J&L leads the industry in melt shop standards for stainless steel—the point where quality starts, **and engineering achievement begins.**

This unique Mobile Laboratory was presented to the University of Michigan by The International Nickel Company. It was adapted from a 27-foot General Motors Coach by Ionia Manufacturing Div., The Mitchell-Bentley Corp. Contributing companies include: General Motors Corp.—Styling Staff, Engineering Staff, Proving Grounds, Truck and Coach Div., Harrison Radiator Div., and Frigidaire Div.; United States Rubber Company; Lyon, Inc.; and Friez Instrument Div., Bendix Aviation Corp.

Plants and Service Centers:
Los Angeles • Kenilworth (N. J.) • Youngstown • Louisville (Ohio) • Indianapolis • Detroit

J&L
STAINLESS
SHEET • STRIP • BAR • WIRE

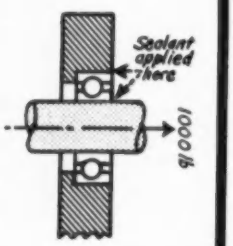
Jones & Laughlin Steel Corporation • STAINLESS and STRIP DIVISION • Box 4606, Detroit 34

Edwin F. Oblinger, Chief Engineer, Parker Sweeper Company, says:

"WE THREW OUT PRESS FITS FOR BEARINGS..."

"We used interference fits to prevent bearing races from turning in the gear box of our 4HP Turbosweeper. Maintaining close tolerances was a constant headache. If the fit was loose, the race would slip and fret the surfaces; if the fit was tight, the race would deform and bearing life would be shortened. Then we discovered LOCTITE Liquid Sealant would do away with the need for press fits. We opened up the tolerances for both shaft and housing and used a slip fit, filling the clearance with LOCTITE. The bearings are retained with a force equal to the customary interference fit, but we've reduced rejected parts from 8% to less than 1% and reworked parts fell from 20% to 0! Field reports are excellent."

LIQUID SEALANT ... replaced interference fits and opened up tolerances almost 0.002 in. on shaft and housing for this ball bearing assembly. Load of over 1000 lbs. is needed to break bond.



LOCTITE is a penetrating liquid that hardens only after being confined between closely fitted metal parts. In the absence of air, the sealant hardens into a strong, heat and oil-resistant bond. The hardening action may be accelerated by heating.

LOCTITE eliminates the need for interference fits on bearings, sleeves, shafts and studs... locks nuts to bolts, seals pipe and tubing joints. For further information write to:

LOCTITE® SEALANT
AMERICAN SEALANTS COMPANY
113 Woodbine St., Hartford 6, Conn.
In Canada: J. S. Parkes & Co., Ltd., Montreal

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recommendations on depreciation legislation to the House Ways and Means Committee in November. This is the first concrete evidence in many months that the serious nature of the depreciation problem is understood by the Treasury and the Internal Revenue Service.

(2) The Senate Small Business Committee, responding to urgent requests from the capital goods industries, listened for a full day recently to management men and tax attorneys concerned with the depreciation problem. The fact that the committee agreed to the hearing is a positive sign, and an indication that the Senate is now more sympathetic than ever before to the needs of both large and small firms for a workable, up-to-date depreciation law.

Relief probably won't be won easily, however. Many politicians will resist, claiming any rewrite of the depreciation laws will mean undue favoritism for the machinery industry and other capital goods industries.

It is therefore quite important that companies which receive the questionnaire from the U. S. Treasury prepare their replies with the fullest attention, and promptly. The whole outcome of the matter depends heavily upon the replies the Government receives to these questionnaires. ■

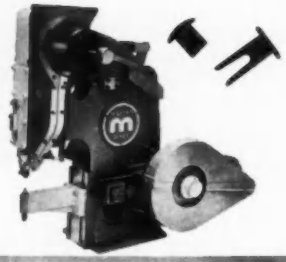
FARM EQUIPMENT

(*Continued from page* 75)

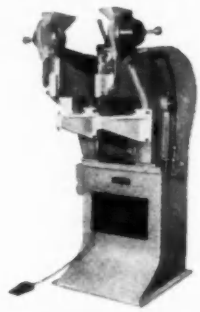
New Model 50 Harvester Added to Allis-Chalmers Line

Pictured is a new Model 50 forage harvester developed by Allis-Chalmers Mfg. Co. It is available with a five-foot direct-cut grass attachment which has a four-bat spring finger type pickup reel and rubberized draper as regular equipment.

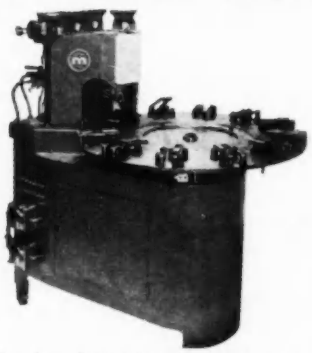
The row crop attachment has a loop type distributor, and power-driven upper and lower rolls which feed such row crops as corn, sorghums and cane butt first across the chopping cylinder. Dual fluted lower rolls are designed to feed the largest corn stalks. ■



CUT RIVET ASSEMBLY COSTS



with Milford's Complete Line of AUTOMATIC RIVETERS



Can be adapted to solve nearly every fastening and assembly problem. For the answers to assembly problems... *get in touch with Milford first!*

THE MILFORD RIVET & MACHINE CO.
MILFORD, CONNECTICUT • HATBORO, PENNA.
ELYRIA, OHIO • AURORA, ILL. • NORWALK, CALIF.

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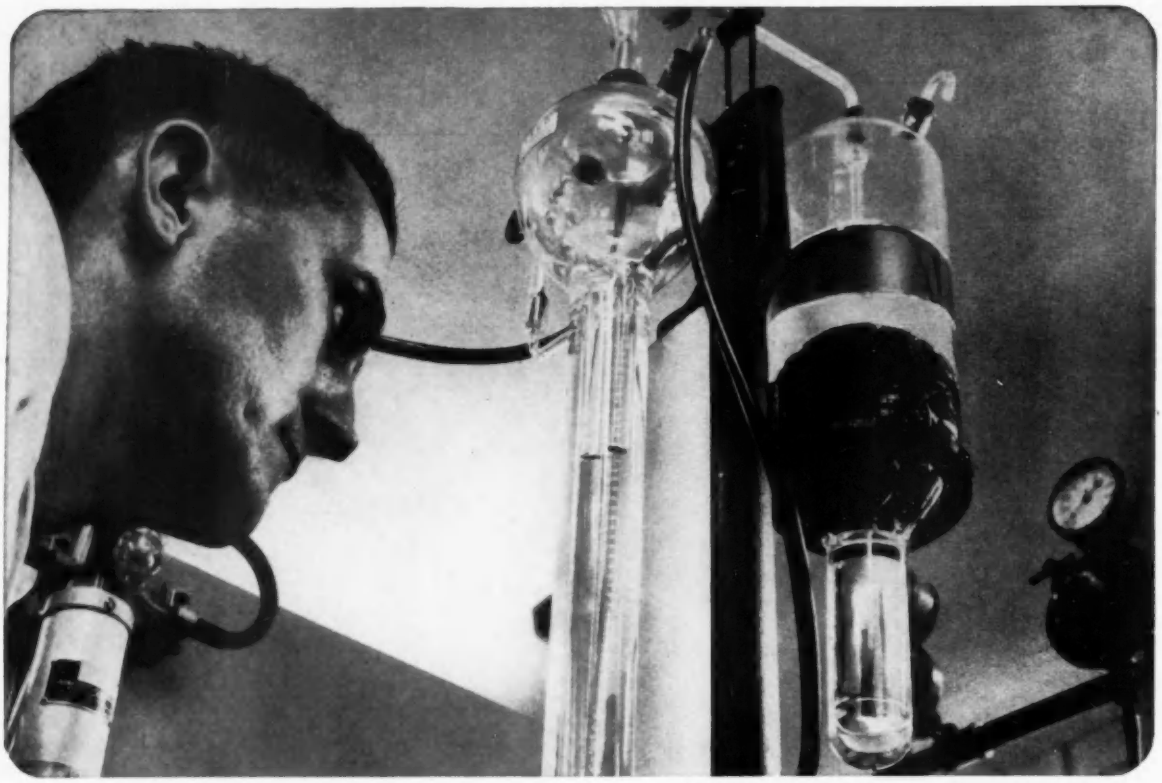
McLOUTH STEEL CORPORATION

HOT AND COLD ROLLED SHEET AND STRIP STEELS

Detroit 17, Michigan

***Experience**—the added alloy in **Allegheny Ludlum** tool steels*



QUICK, FAST TESTING for carbon content is done not once or twice but 8 times per melt in A-L's Chem Lab with this direct reading Leco carbon determinator.

Carbon content checked 8 times during melt to guarantee A-L tool steel hardenability

Lab tests for carbon eliminate your guesswork; provide high hardness, uniform hardenability, reproducible tool performance.

Because carbon has the greatest influence on hardenability, Allegheny Ludlum watches it carefully during the melt. Testing a specimen for carbon takes only a few minutes. Therefore, A-L checks for carbon content 8 times during the melt, and makes the necessary adjustments to insure accurate control of carbon. This control means Allegheny Ludlum can hold carbon content to a closer range than most customers specify.

Carbon control at Allegheny Ludlum assures you of precise response to heat treating. This control in the melt brings you predictable, *high hardness, uniform hardenability* and *reproducible tool performance.*

This is just one of the many things A-L does to insure high quality. Here are some others: close control over forging techniques, rigid temperature-time programming, careful testing of billets prior to processing to insure good surface and sound interior, control over annealing to give you the right hardness for your exact machining operation, thorough metallurgical testing to insure top tool steel quality and meeting of your specifications.

Allegheny Ludlum stocks a complete line of tool steel sizes and grades. Call your nearest A-L representative; you'll get quick service and counsel on such problems as heat treating, machining, grade selection, etc. Or write for A-L's publication list which gives full data on the more than 125 technical publications offered. They'll make your job easier.

ALLEGHENY LUDLUM STEEL CORPORATION, Oliver Bldg., Pittsburgh 22, Pa. Address Dept. AI-20.

WSW 7261

ALLEGHENY LUDLUM

Tool Steel warehouse stocks throughout the country... Check the yellow pages

every grade of tool steel... every help in using it

Circle 181 on Inquiry Card for more data

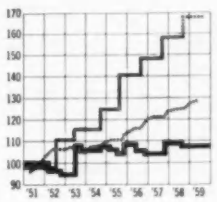
WHY YOU CAN'T GET TIMKEN® BEARING QUALITY IN ANYTHING BUT TIMKEN BEARINGS

Labor over a bearing design until you have perfect geometry. Develop heat treating to give parts hard wear-resistant surfaces over tough, shock-resistant cores. But unless you use nickel-rich steel, you'll have omitted the heart of the matter, the payoff for all your efforts.

That's why we make steel that's nickel-rich for Timken bearings. Nickel-rich steel responds best to heat treating, gives the wear and shock-resistance you need in truck and passenger car bearings. We make this steel ourselves to control quality every step of the way.

Your engineers know that Timken® *tapered* roller bearings stand up better in cars, trucks and busses. And your production people know that the uniform dimensions of Timken bearings save assembly and adjustment time. So if you're looking for ways to cut assembly and warranty costs, ask your own technical people about Timken bearings.

You get this extra quality at no extra cost when you buy Timken bearings. Using the most modern production techniques in the industry at our revolutionary Bucyrus, Ohio plant, we're producing "Green Light" bearings, to lead the way in keeping bearing quality up, costs down as shown in the chart. And our engineers give you service you can't get anywhere else. Why settle for less? So specify Timken "Green Light" bearings —not just a part number—and cut your bearing costs. The Timken Roller Bearing Company, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*



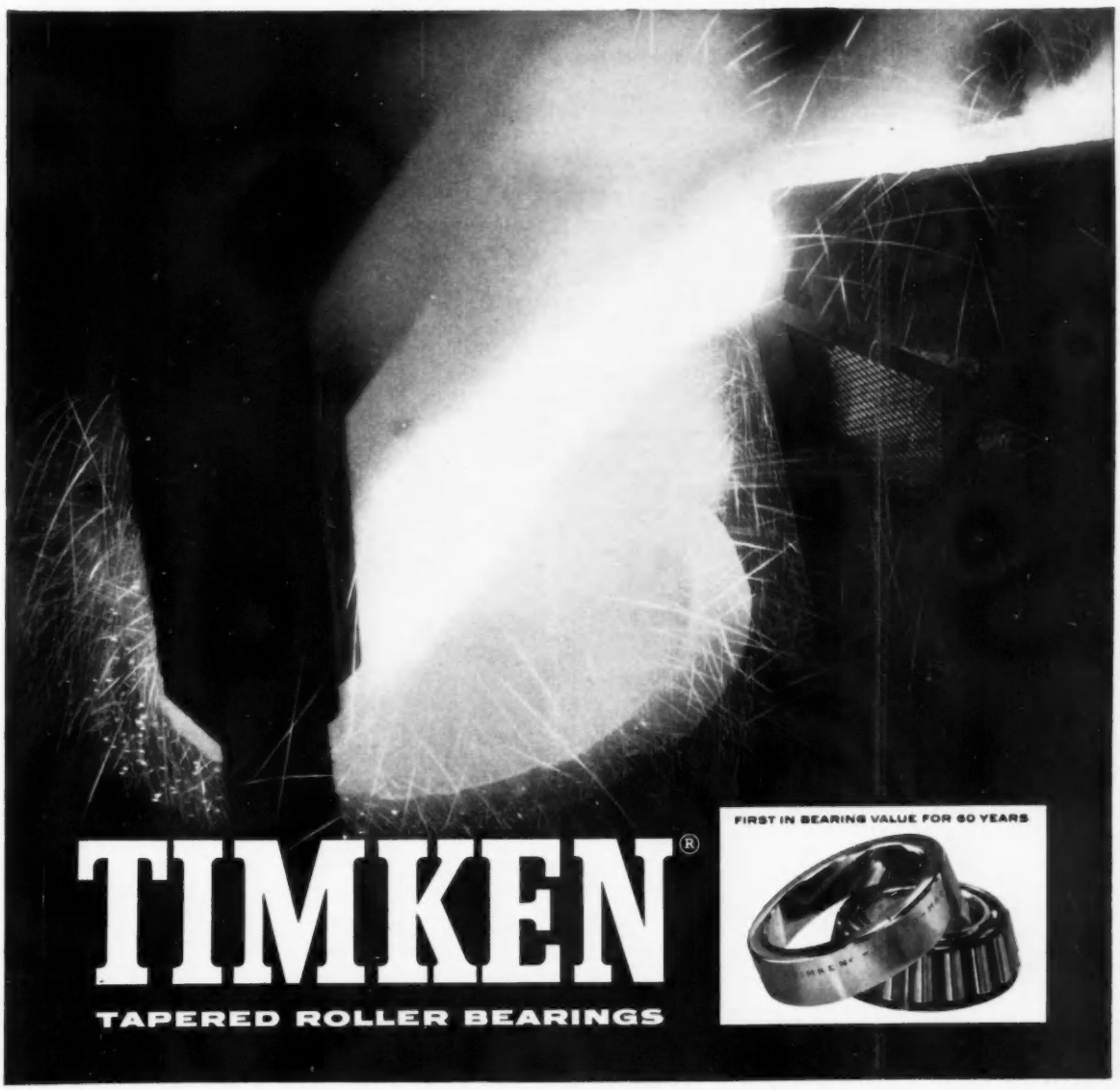
While many costs have gone up, the cost of Timken bearings has stayed low.

— TIMKEN COMPANY LABOR COSTS

------ PASSENGER CAR PRICES*

— TIMKEN BEARING PRICES

Index base, 1951=100
*BLS wholesale prices



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SELF-CONTAINED SLITTERS

YODER SLITTERS

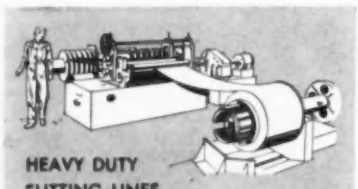
basic equipment for cost-conscious users of strip!

To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths . . . completely engineered lines for special requirements.

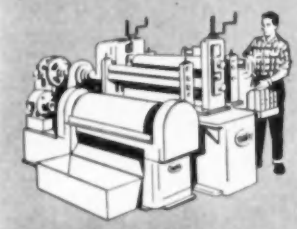
YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the fully illustrated descriptive, YODER Slitter Manual; it's yours for the asking. Write to

THE YODER COMPANY
5553 Walworth Ave. • Cleveland, Ohio



HEAVY DUTY SLITTING LINES



SCRAP CHOPPERS

ENGINEERING YODER MANUFACTURING ROTARY SLITTING LINES

Circle 170 on Inquiry Card for more data

Unprotected Magnesium Performs Well in Automotive Parts

(*Continued from page* 61)

If salt-spray tests had been the sole criterion, magnesium might not have been specified for any of these parts. As it is, the success of magnesium prototype parts in road tests has proved to be the only reliable indicator of how the metal performs in service. This conclusion applies as well to other metals.

Thus far, exterior service with magnesium in American cars does not include parts in the rear, nor has the metal been used in such parts as engine blocks and covers. But the highly successful use of magnesium in the crankcase and transmission housing of the rear-engine Volkswagen indicates that this metal will perform successfully in the corresponding parts and areas of U. S. vehicles.

The manufacturers of Volkswagen report that they know of no corrosion problems involving the magnesium castings of these cars, even in countries with rigorous climates like Canada and Sweden. Volkswagen started using magnesium on a large scale in 1949.

Interior parts requiring an attractive appearance offer no problem at all in magnesium as the metal is finished with the same paint systems as the metals it replaces. Examples in current or previous model cars include defroster vents, instrument bezels and panels, and steering column shrouds, brackets, and clamps.

To illustrate the good corrosion resistance of magnesium in automotive application, The Dow Chemical Co. recently made a spot check of a variety of magnesium parts on cars in actual service. Photographs of several of the parts accompany this article. All are production parts. All of the exterior parts were put in service either bare or with a chrome pickle dip except for a power steering oil reservoir cover which was painted on one side because it was part of an assembly requiring paint to protect another metal. Before being photographed, the parts were cleaned by vapor degreasing to remove grease, oil and dirt. ■

BUY BONDS

Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench: metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301-L North 11th St. • St. Louis 6, Mo.

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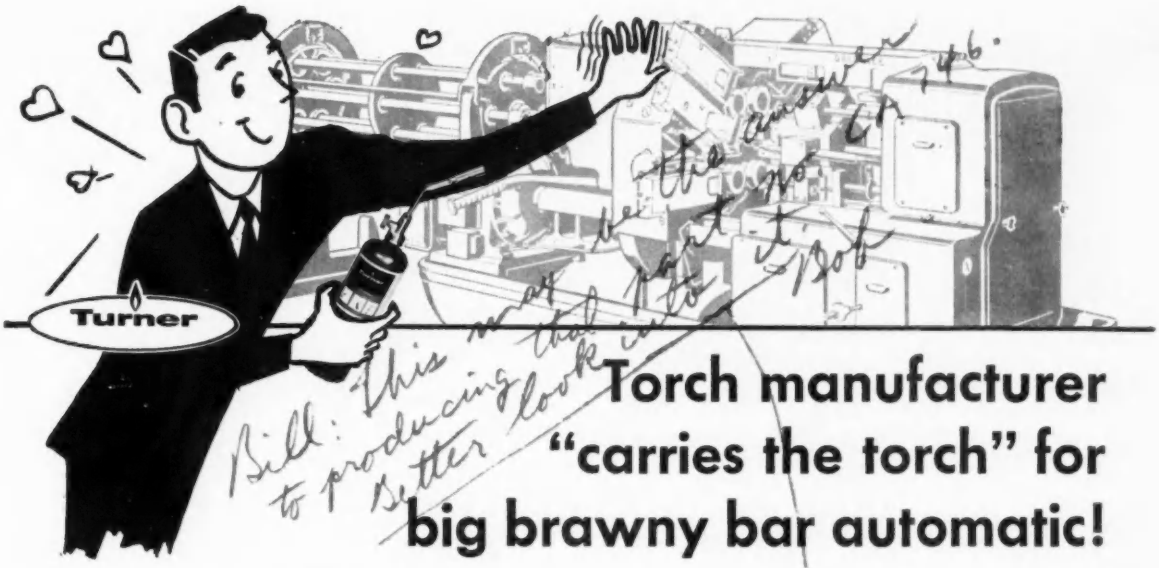
CUT SCRAPER TIME
END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301-L NORTH 11TH ST., ST. LOUIS 6, MO.

Circle 172 on Inquiry Card for more data



Torch manufacturer "carries the torch" for big brawny bar automatic!

Growth of a company from the founder's first fond dream to a leading place in the industry is a matter of continuing product improvement, sound management, ever-increasing efficiency, keeping pace with changing times. Read what a line of machines named Greenlee means to a company named Turner . . . and why, out Sycamore-way, they "just love those Greenlee Bar Automatics" . . .

The Great Fire of 1871 struck and scarred Chicago the very same year that enterprising Edward S. Turner "hung out the shingle" at 4 LaSalle Avenue and proclaimed to one and all that The Turner Brass Works was ready for business.

It's a long way from the Horse Age to the Age of H-Power . . . 1871 to 1959. A whole way of living changed, new products came to the fore. Alert, trend-conscious Turner kept pace with the advancing times, moved the factory to Sycamore, Illinois in 1906 . . . expanded its operations steadily until today the Turner Corporation spans 100,000 square feet of factory space, and turns out products ranging from propane torches to plumbing fixture fittings—blow torches to diesel engine starting aids—camp cook-stoves and lanterns to furnaces and furniture hardware.

Along that route Turner continually met the old familiar problem: *How to get high-speed production and maintain top quality.*

That's where Greenlee enters the picture, and the Case of the Propane Torch is a typical example. It's a "How-They-Dunit" that may hold eye-opening suggestions for some of *your* production problems.

Turner's Propane Torch suddenly became a "hot" item — hot as its glowing tip. An expanding nation-wide need for it in home and shop at length blossomed into an enormous increase in demand. The order went out: "Turn 'em out faster — but keep quality up — keep cost in line." How to do it was the question.

Turner management launched an exhaustive investigation of top-rated production machines on the market. They probed, tested, ran trial runs. Eventually they found a machine that seemed to do everything they asked. It took 9/16" round brass stock, gave it a merry whirl — 298 surface feet per minute on stock diameter—2029 revolutions per minute.

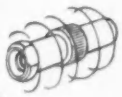
Quality tested consistently high, rejects were held to a minimum, a complete operation was eliminated, as the husky Greenlee Bar Automatics "rolled 'em out" with the tireless gait of a 'round-the-clock marathoner.

That's when a long and happy association began. For shortly thereafter, the Turner P.A.'s signature was on a purchase order for a battery of Greenlee Automatics with special attachments.

A look at the Job Progress schedule will give you an idea of how efficiently they tick off a 6-stage operation on mixer tubes:

1st Position:
The big Greenlee Cam-Feed 1-5/8" Six-Spindle Bar Automatic uses a 1" tool slide stroke with .0063 inch feed on the endworking tools. Stock is fed out to length during indexing, spot-drilled, knurled (using a standard plunge-type knurl holder and a two-roll roller rest)

2nd Position:
The mixer tube is faced by a knee turner while a .277 inch diameter drill, mounted on a high-speed drilling attachment, drills to depth.



3rd Position:
Outside diameter is sized by a standard dovetail form tool. A .187 inch hole is drilled partway, as a two-roll roller rest supports the part.

4th Position:
Using a standard milling attachment mounted on the tool slide, the two parallel flats are milled. (Attachment consists of two milling cutters mounted on a keyed arbor in the milling head). Milling head rotates at the same r.p.m. as the workpiece; internal gearing in the attachment rotates the milling cutters at proper speed for the milling cut.

5th Position:
The .187 inch hole is drilled to depth while a standard cut-off tool breaks down for cut-off.

6th Position:
A 5/16" — 27 thread is tapped, and the part is cut off.

FINAL SCORE:

580 high-quality mixer tubes per hour at gross production rate. One complete operation eliminated. Rejects at an all-time low. . . . No wonder, out Sycamore-way, they "just love those Greenlee Bar Automatics" — big — brawny — and *bears for the jobs where you've got to keep your quality reputation as you keep up with market demand.*

Question:
Have *you* looked into Greenlee, lately, for quality on a production basis?

GREENLEE BROS. & CO.

GREENLEE
1867 Mason Avenue
Rockford, Illinois

Circle 173 on Inquiry Card for more data

NATIONAL LOCK FASTENERS

to your "specs"

National Lock Company sales engineers will work with you in solving all your fastener problems. Our extensive engineering and production facilities are geared to handle your requirements for special-purpose or standard fasteners of uniform quality . . . delivered on time. Write us.

"KEPS" ® REGISTERED TRADEMARK OF ILLINOIS TOOL WORKS

NATIONAL LOCK COMPANY
FASTENER DIVISION ROCKFORD, ILLINOIS

Men at Work

in the private offices and in all corners of automotive and aviation industrial manufacturing plants, influence the buying of materials, tools, machinery and equipment.

In addition to the buyers whom your own salesmen contact

AUTOMOTIVE INDUSTRIES

reaches men whose names you'll never know — but whose recommendations may mean millions to you.

Also Automotive Industries helps to create and maintain the good reputation of your product in quarters where that help will do the most good

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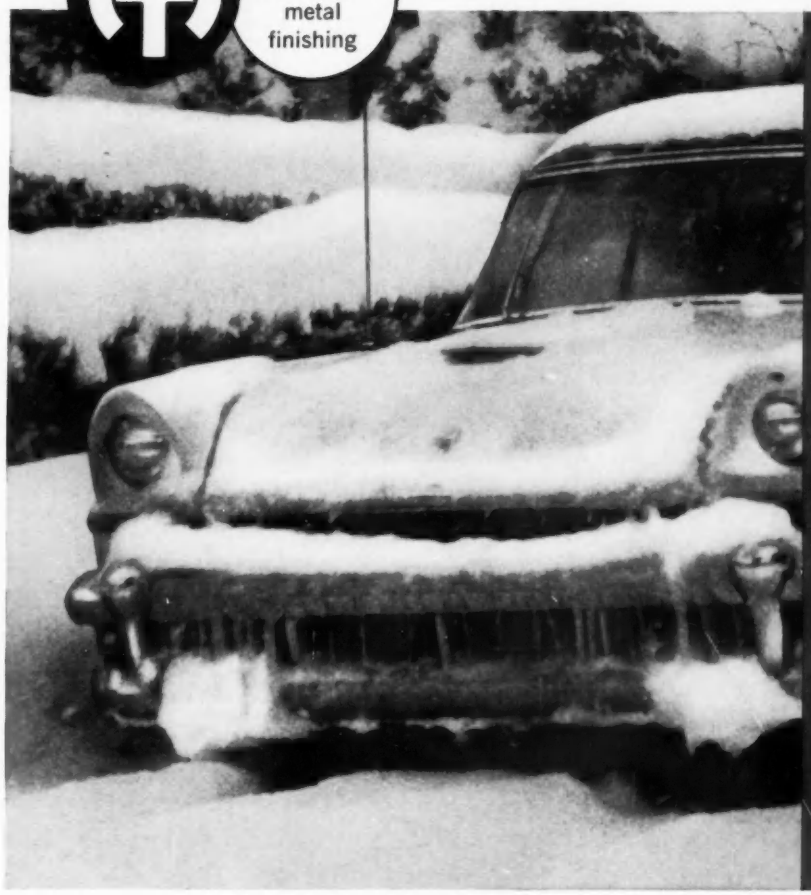
Automotive Industries

A Chilton Publication

Chestnut & 56th Sts. Philadelphia 39, Pa.

What M&T is doing in metal finishing



Brightwork can stay bright now...

New M&T Chromium Plating Discovery offers most economical way to improve durability

Durability of chromium plated parts in severe, accelerated corrosion tests has been increased up to 500% by the revolutionary Unichrome "Duplex Chromium" Plating Process developed by Metal & Thermit.

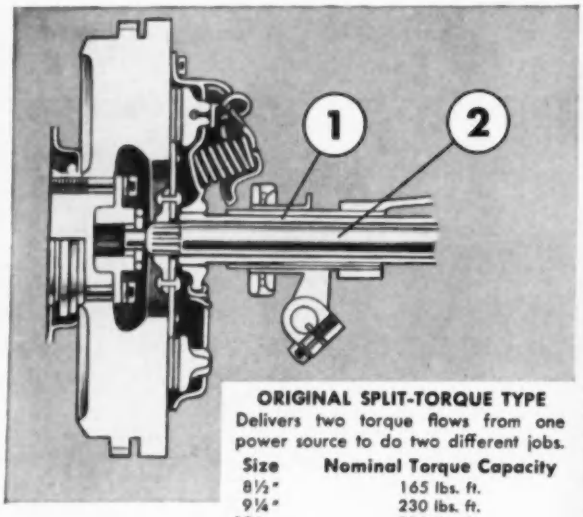
Using M&T "Duplex Chromium" to increase the thickness of chromium approximately five times from the usual average of 10 millionths of an inch enables parts to maintain an ASTM durability rating of 8 or better (10 is *perfect*)! This thicker and more uniform chromium plate radically increases survival time in modern accelerated tests by many times over.

M&T "Duplex Chromium" consists of a layer of Unichrome Crack-Free Chromium which blocks infiltration of corrosives to underlying metal. It is followed by another layer of Unichrome SRHS® Chromium to build up proper thickness. The additional millionths of an inch more chromium, in these two layers, do more for outdoor durability than any other change in present plating procedure. Results show that per dollar invested in equipment and solutions, this new technique gives greater benefits than a corresponding expenditure for thicker copper and nickel undercoats. It saves on capital investment because existing production equipment can be used. It saves by cutting rejects of parts which are now required to survive more rigorous life tests than heretofore.

Simply by adding the few additional minutes to plating time and using M&T "Duplex Chromium", you can add *years* to the life of chromium plated finishes in outdoor exposure. Send for data. Or ask the M&T Man about it.

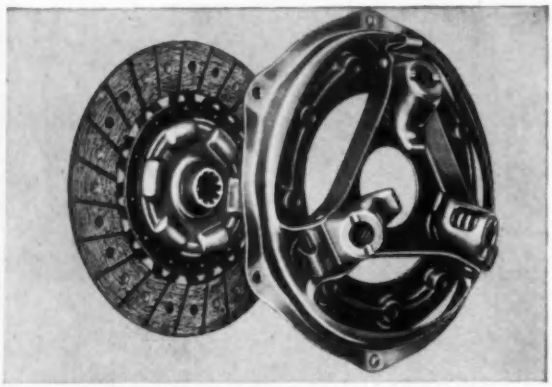
METAL & THERMIT
CORPORATION
GENERAL OFFICES: RAHWAY, NEW JERSEY

Circle 175 on Inquiry Card for more data



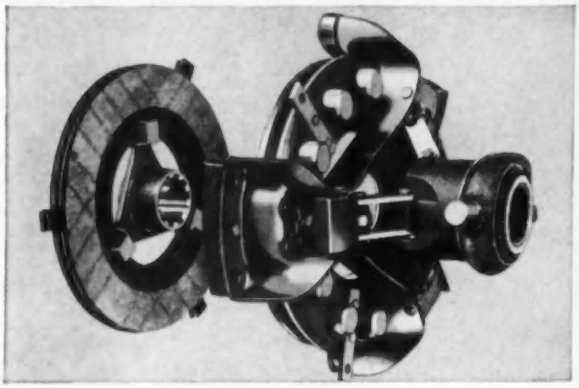
ORIGINAL SPLIT-TORQUE TYPE
Delivers two torque flows from one power source to do two different jobs.

Size	Nominal Torque Capacity
8½"	165 lbs. ft.
9¼"	230 lbs. ft.
10"	280 lbs. ft.
11"	320 lbs. ft.



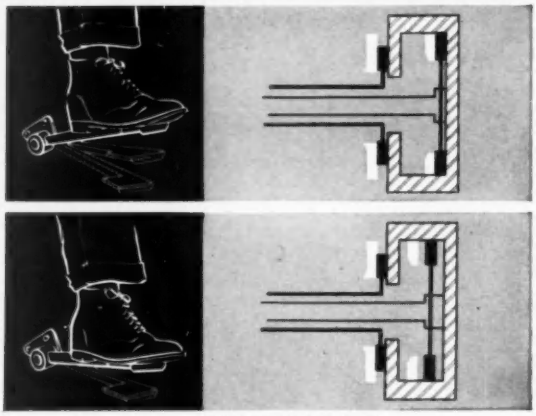
SPRING LOADED TYPE WITH DAMPER DISC
For smooth drive on tractors and self propelled implements.

Size	Nominal Torque Capacity
6½"	80 lbs. ft.
8"	140 lbs. ft.
8½"	165 lbs. ft.
9"	200 lbs. ft.
9¼"	230 lbs. ft.
10"	280 lbs. ft.
11"	320 lbs. ft.



CONSTANT PRESSURE TYPE
For live PTO in tractors and other heavy duty applications.

Size	Nominal Torque Capacity
6½"	93 lbs. ft.
9"	115 lbs. ft.
14"	720 lbs. ft.
15"	800 lbs. ft.
17"	1420 lbs. ft.



DUAL DRIVE TYPE
Supplies selective drive to both tractor and machines with single pedal control.

Size	Nominal Torque Capacity
9"/11"	152/202 lbs. ft.
10"/12"	261/306 lbs. ft.

4 TYPES OF SPICER CLUTCHES
For All Types Of Agricultural Drives

It's a lot simpler to call on Spicer when you need a clutch! You specify the capacity or select the type and Spicer has it . . . in a well-rounded line that fits your every need.

Write now for complete information on all 4 types of Spicer agricultural clutches. Or call the Dana engineer for expert assistance on all your clutch and accessory drive problems.

DANA Spicer

DANA CORPORATION • Toledo 1, Ohio

SPICER PRODUCTS: Transmissions • Universal Joints • Propeller Shafts • Axles • Torque Converters • Gear Boxes • Power Take-Offs Power Take-Off Joints • Rail Car Drives • Railway Generator Drives Stampings • Spicer and Auburn Clutches • Parish Frames • Spicer Frames

Circle 176 on Inquiry Card for more data

PHOTO BY KARSH OF OTTAWA

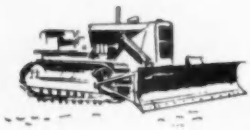
"Supplier interest is what makes Sharon Steel important to us"—L. F. SMITH, Erie Plant Manager, A. O. Smith Corp.

"We of A. O. Smith take unusual pride in our products," says L. F. Smith, Erie Plant Manager of the A. O. Smith Corporation, "and we like to see our suppliers share this interest."

"We are extremely proud of our new line of gasoline pumps for they combine appearance, ease of operation and low maintenance into a real standout product. Our people tell me that the design, production and purchasing functions were made a great deal easier because of the sincere concern and help of such leading suppliers as the *Sharon Steel Corporation, Sharon, Pa.*"

SHARONSTEEL **SHARON** *Quality* **STEEL**

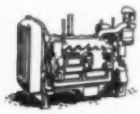
Circle 177 on Inquiry Card for more data



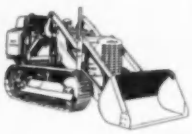
Challenging Engineering Opportunities at CATERPILLAR

be a part of the company building the world's most complete line of earthmoving equipment

Find the satisfaction of *growth* and *stability* within a *growth* company – where imaginative men are creating products for highway construction – industry – farms – national defense – products which build a better world.



Caterpillar offers top ranking Research and Development opportunities – stimulating assignments – professional and personal advancement. You'll associate with the leaders and pioneers in this field – and have at your command the finest equipment, laboratories and development facilities. Please write us, telling all about yourself. Inquiries are confidential, of course.



(Below – New Caterpillar Technical Center presently under construction)

responsible positions available in
RESEARCH — DESIGN DEVELOPMENT

GAS TURBINE LABORATORY
Design, ignition, fuel and combustion systems, etc.

ENGINE DEVELOPMENT LABORATORY
Fuel injection, turbocharged engines, combustion, etc.

VEHICLE COMPONENTS LABORATORY
New power shift transmissions, transmissions, controls, clutches, final drives.

VEHICLE DEVELOPMENT LABORATORY
Quantitative and comparative performance evaluation, soil mechanics, full scale load analysis.

PRODUCT AND APPLICATION ENGINEERING DESIGN
Engines, systems, fuel injection, tractor, transmission, vehicle configuration, earthmoving machinery.

SEND RESUMÉS TO:
John A. Myers — AI-89
Professional and Technical Employment

CATERPILLAR TRACTOR CO.
PEORIA, ILLINOIS

give the *gentleman* what he wants...

Yes . . . that means piston ring PRECISION, too!

Precision is one of the ingredients we have uppermost in mind as we daily seek to live up to our service slogan for the Automotive Industry . . . GIVE THE GENTLEMAN WHAT HE WANTS. We know he wants precision in all things. And the Chef never lived who could slice to the fine tolerances we do in making piston rings for the car factories . . . truck makers . . . engine builders. In our temperature conditioned plant at Manchester, Missouri, every known step of precision control is taken . . . specially-designed machines have been developed . . . so that the GENTLEMAN WILL GET WHAT HE WANTS in ring parallelism, flatness, finish, tolerance, quality control.

Why not begin a trip through our plant by sending for the booklet, "MOST MODERN RING PLANT." It will introduce you to the results of more than fifty years of serving the great automotive industry . . . a plant geared to giving THE GENTLEMAN WHAT HE WANTS.

© 1958 Ramsey Corporation M-612

TRW

Piston Rings by THOMPSON PRODUCTS RAMCO DIVISION

Another Product of ***Thompson Ramo Wooldridge Inc.*** *AUTOMOTIVE GROUP Serving the nation's manufacturers of cars · trucks · tractors · engines*

1 **Light Metals Division** — impact extrusions, aluminum permanent-mold and high-pressure die castings; forged and cast aluminum alloy pistons.

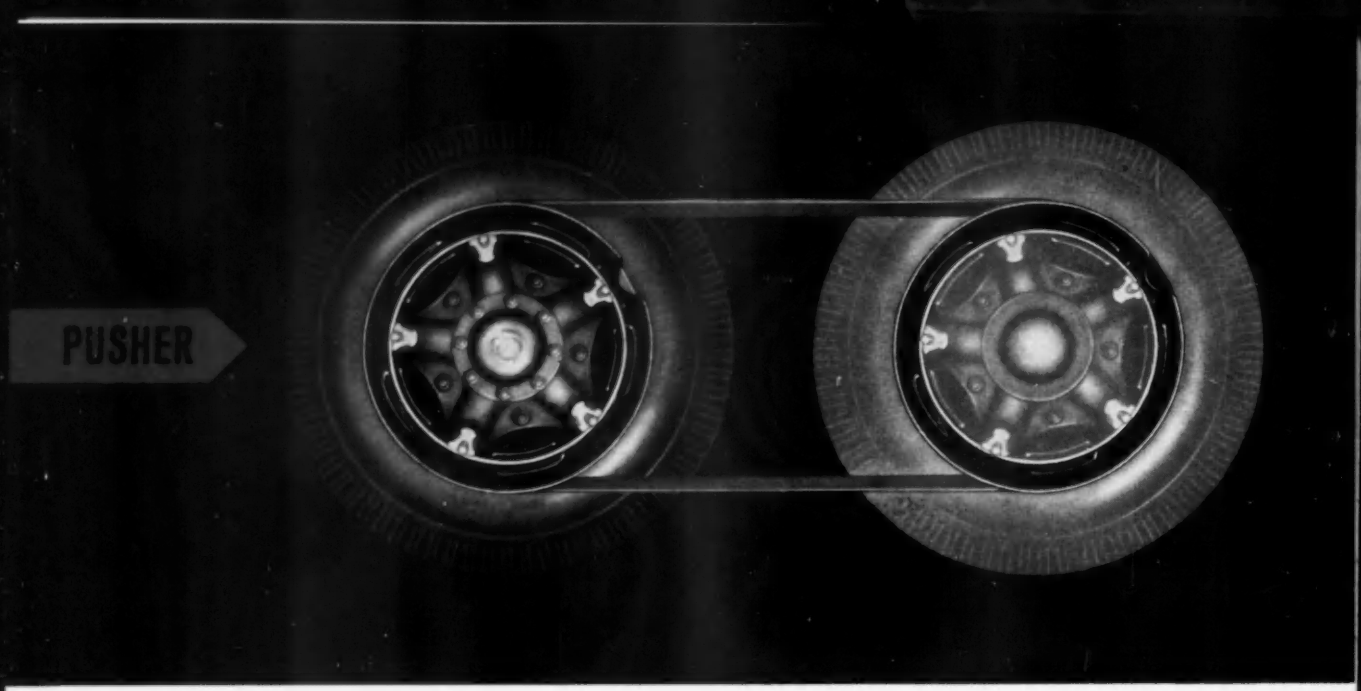
2 **Motor Equipment Manufacturing Division** — water pumps; piston pins; transmission control valves.

3 **Michigan Division** – steering linkages; front wheel suspension ball joints; driveshaft bearing hangers; track-bars; cylinder sleeves; radius rods; power steering cylinders and pumps; transmission pumps; hydraulic actuating pumps.

4 **Valve Division** — valve and valve seat inserts; valve rotatots; valve retainer locks and caps; mine roof bolt expansion shells; mechanical control components for missiles.

5 **Ramco Division** — Piston Rings; "Spirolox" and "Circolox" Retaining Rings. Address your inquiries to Thompson Products Ramco Division, Box 513, Dept. H, St. Louis 66, Mo.

Circle 179 on Inquiry Card for more data



1,000 lbs. more payload potential . . .

DAYTON THORO-TRAC®

Minimize wheel spin

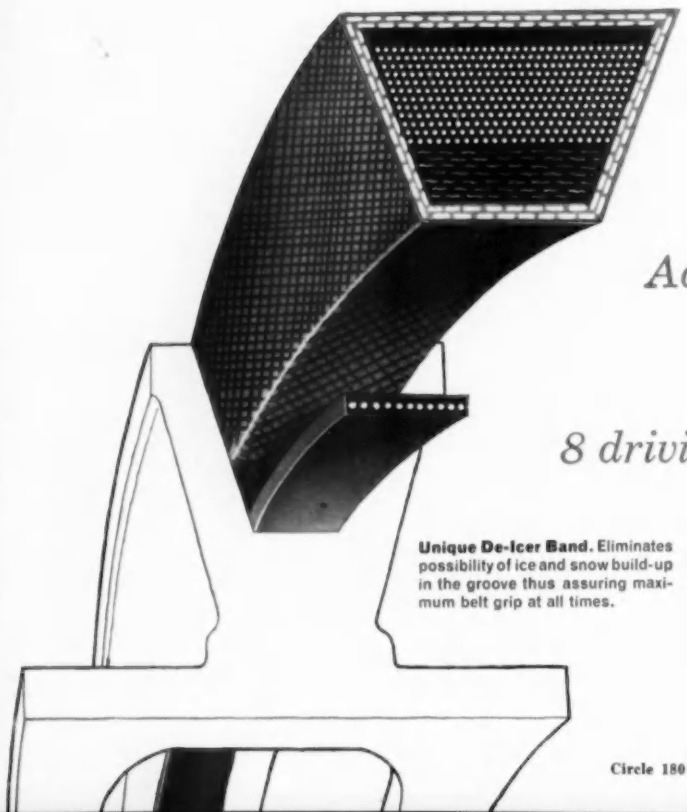
Reduce tire hopping

Equalize Braking

Add tire mileage

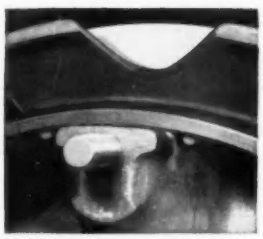
Added traction

8 driving tires instead of four



Unique De-Icer Band. Eliminates possibility of ice and snow build-up in the groove thus assuring maximum belt grip at all times.

Unique Seating Notch. Dayton designed notch in sheave simplifies belt seating. Belt placed in notch actually seats itself by merely rotating wheel. Thoro-Trac assemblies available for spoke and disc type wheels.



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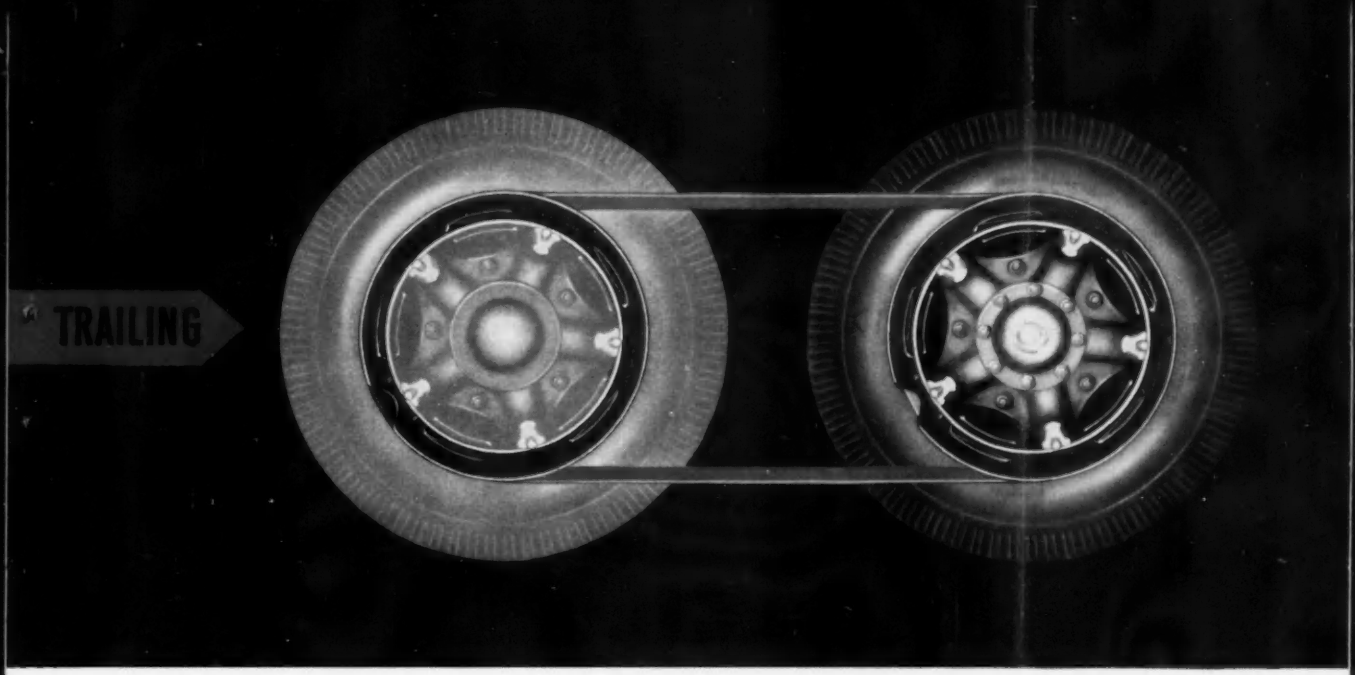


. . triple tire life with

V-BELT DRIVES

Fleet operators, tandem drives need not cost a lot of money . . . they can be surprisingly inexpensive when you install Dayton Thoro-Trac V-Belt Drives. Installation is easy, yet it is an efficient, dependable means of automatically doubling your traction to eight driving tires instead of four. Because the Dayton Sheave has a unique notched groove, it is easy to seat the V-Belt. No tools are needed.

By adding this NEW asset to your fleet you'll increase tire mileage, double traction and equalize braking effectiveness. In addition, you'll have less wheel spin and tire scuffing, less danger of side slippage, adding thousands of miles to tire life. With two powered axles you'll get more pulling power. You actually save up to 1,000 lbs. in dead weight over other type tandem drives as well as important savings in actual cost.

There's nothing complicated about the installation of the lightweight Dayton Thoro-Trac V-Belt Drives. In the hands of your competent maintenance men, you can easily convert your present vehicles to assure greater safety and increased profits. Why not ask your local Dayton distributor for complete information or write Dayton Industrial Products Co., Tandem V-Belt Sales, 2001 Janice Ave., Melrose Park, Illinois.

® Registered trademark. The Dayton Rubber Co. © D. R. Co. 1959

Dayton Industrial Products Co.

Melrose Park, Illinois — *A Division of The Dayton Rubber Co.*

I'm interested in increasing payload potential and tripling tire life of my fleet. Please send Dayton Thoro-Trac V-Belt Drive folder . . . A-3172-58.

Name_____

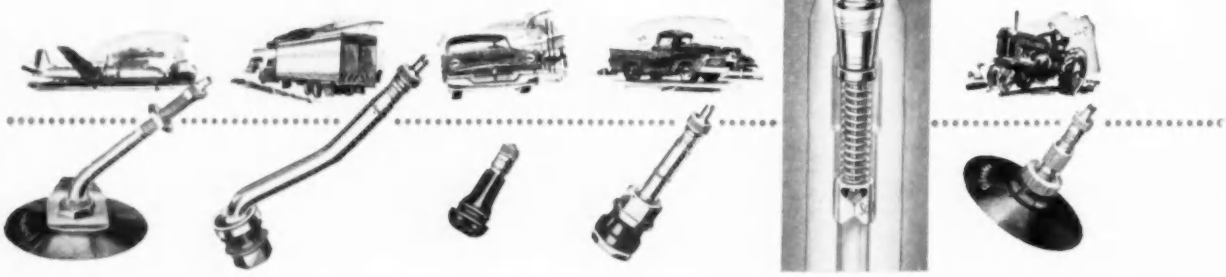
Firm Name_____ Address_____

City_____ Zone____ State_____

ANYWHERE IN THE WORLD...ANYONE

ACE OF STANDARDIZATION

the name for Schrader's famous tire valve operating principle



CAN AIR-SERVICE TODAY'S TIRES

years of tire valve standardization make it easy

On the other side of the world, servicemen are using the same American tools, parts and methods to service vehicles as the man in the station down the block. Tire service is fast and easy because of standardization, but this situation didn't just happen. The U. S. Automotive, Tire and Tire Valve Industries combined their skills and experience not only to maintain highest quality while mass producing at lowest cost, but to produce interchangeable air valves and tools that make service possible anywhere a vehicle goes. Schrader's job is to utilize all the Industry know-how and produce the safest, most practical and dependable valves for all types of pneumatic tires.

Count on quality Schrader Tire Valves to match the performance of your vehicles . . . because the "Ace of Standardization" design can be serviced anywhere in the world.

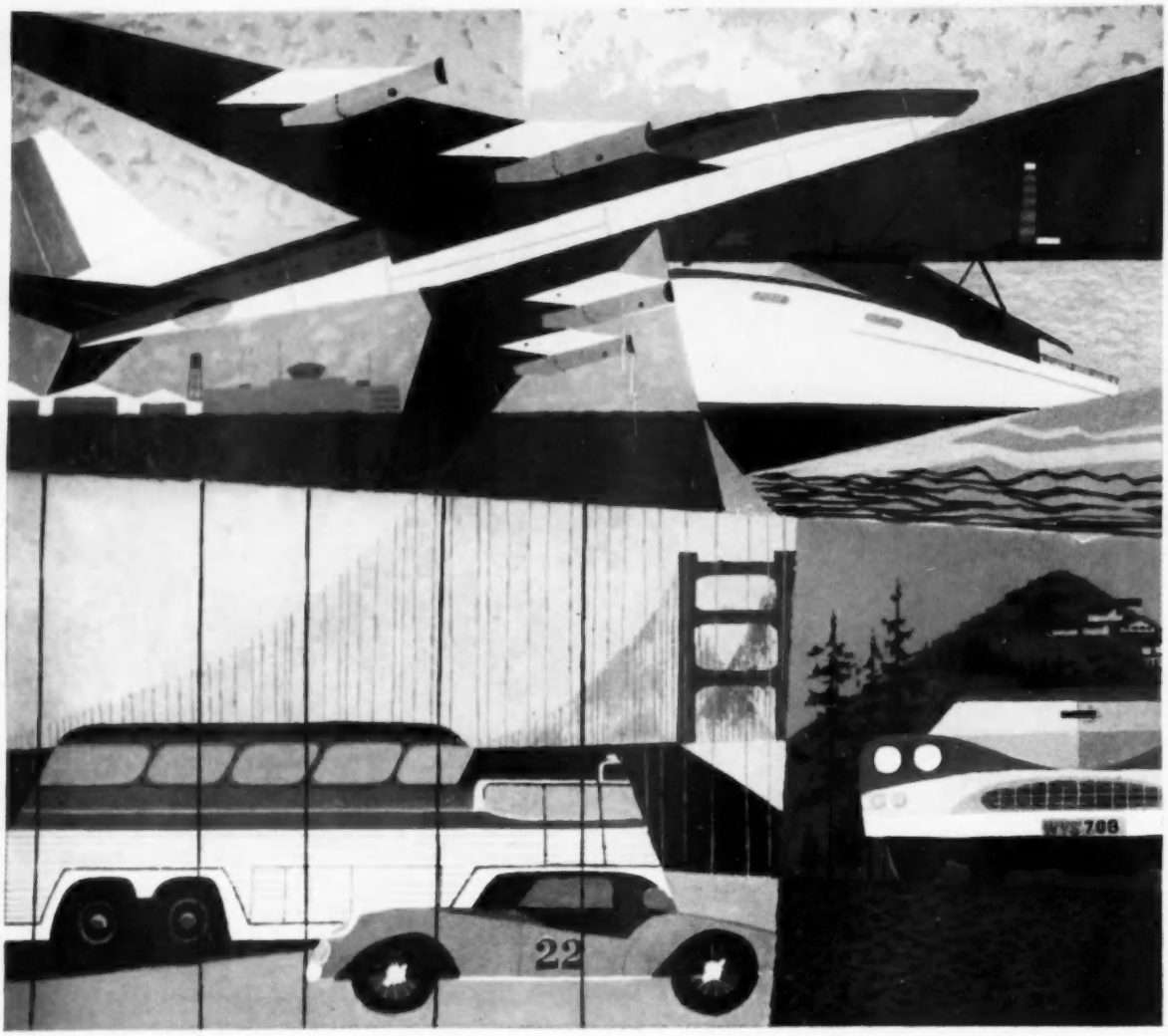
Schrader®
a division of SCOVILL

A. SCHRADER'S SON • BROOKLYN 38, N. Y.
Division of Scovill Manufacturing Co., Inc.

FIRST NAME IN TIRE VALVES

FOR ORIGINAL EQUIPMENT AND REPLACEMENT

Circle 169 on Inquiry Card for more data



ELECTRONICS PROBLEM? SEE AC!

Get the facts on this new transistorized inverter

New AC Transistorized Inverter, exterior-interior views.

AC is a leader in solving electronics problems —and in the forward planning of electronics equipment to solve anticipated problems.

AC's new Transistorized Inverter offers a prime example of AC's electronic leadership. This newly developed device converts low voltage direct current to high voltage alternating current for the operation of fluorescent lights and small motors in buses, airplanes, cars and boats.

Its big advantage is in transistor action which accomplishes current conversion without need for any rotary or vibratory moving parts.

This means lower installation cost—as much as 50% less than conventional mechanical types.

And it means far lower operational cost—with longer life and greater reliability—since no lubrication, maintenance or replacement parts are required.

The 125-watt unit, recommended for most installations, is approximately 3″ x 5″ x 5″, weighs only 2½ pounds and is designed to operate throughout an ambient temperature range of −40°F to +160°F with high efficiency. It is self-protecting in event of shorted load.

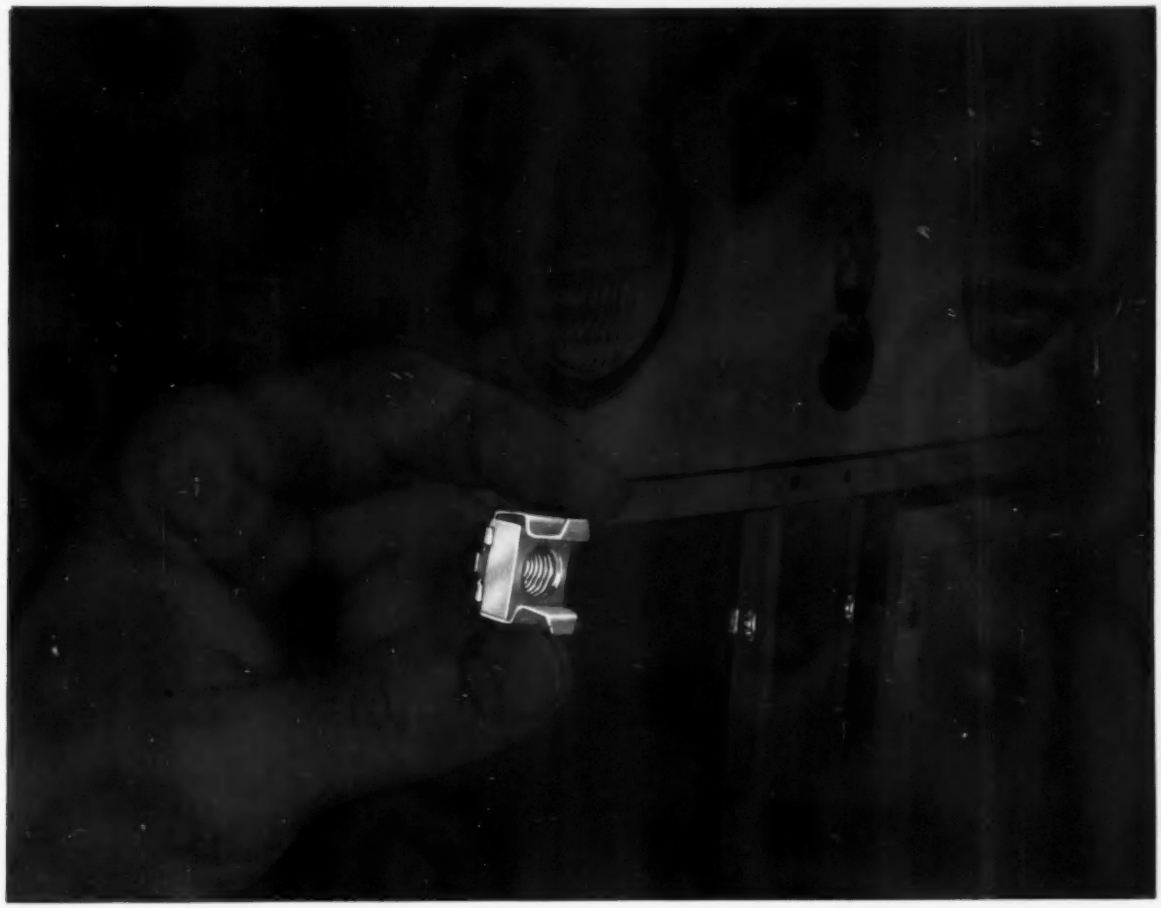
Do you have a battery-powered alternating current problem? Let us help you with complete information on the AC Transistorized Inverter and other advanced AC Engineering ideas.

AC Reliable Products Help You Sell

AC SPARK PLUG — THE ELECTRONICS DIVISION OF GENERAL MOTORS

FLINT—1300 North Dort Highway, CEdar 4-5611 | CHICAGO—7074 North Western Avenue, ROgers Park 4-9700 | DETROIT—General Motors Bldg., TRinity 5-2630 | LOS ANGELES—5670 E. Washington Blvd., RAymond 3-5171

Circle 183 on Inquiry Card for more data



Another Tinnerman Savings Story...

Easier, faster, better, cheaper...4 reasons to use **SPEED GRIP**® Nut Retainers

Easier ... because anyone anywhere on the J. I. Case tractor production line can snap the spring steel retaining legs of the SPEED GRIP into punched panel holes. No special skill required. Hole alignment is no problem – the nut "floats" inside the cage to compensate for normal tolerances in the parts being assembled.

Faster ... no staking, no welding. No retapping of paint-clogged threads because SPEED GRIPS can be applied *after* painting. And they pop quickly and easily into position for final assembly.

Better ... heavy-duty SPEED GRIPS make possible sturdy, reliable attachments because both the cage and the nut are made of high quality steel. In case of accidental cross-threading, the SPEED GRIP can easily be replaced. You never have to "make do" with a sub-strength fastening.

Cheaper ... J. I. Case estimates a savings of about 30% per fastener over the previous method.

Want to achieve these benefits of SPEED NUT Brand Fasteners for your product? Refer to your Sweet's Product Design File, section 7-Ti, then call your Tinnerman representative (listed in most Yellow Pages under "Fasteners"). Or write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P.O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Bundy GmbH, Heidelberg.

Circle 184 on Inquiry Card for more data

Are you bright about brightwork?

Have you noticed how some parts of your car trim stay bright while the luster of others disappears? The stay-bright parts are undoubtedly stainless steel.

The 1959 cars have more stainless than ever before. Stainless is bright all the way through—can't flake or peel. And it's dent-resisting: That's why those long, glistening body strips are stainless. They protect. Stainless resists the corrosive action of road salts, too, better than any other metal now used.

Republic Steel, the world's largest manufacturer of stainless and alloy steels, is one of the biggest suppliers of stainless to the men who make automobile trim.

The managements of the plants which fabricate trim are masters at efficiency. Here they have carried the economics of mass production to a peak in that industry which originated mass production techniques. When you wonder (as more people might well do) why average Americans can enjoy beautifully trimmed cars, reserved elsewhere in the world for only the very privileged few, your answer will be found in the efficiency of such men as those who manage these fabricating shops.

REPUBLIC STEEL

CLEVELAND 1, OHIO
WORLD'S WIDEST RANGE OF STANDARD STEELS AND STEEL PRODUCTS

portance in this improved technology, but neither can be exploited analysis of engineering tests reveals that the best of our current standard wheeled vehicles has a 42 per cent probability of completing 20,000 miles before requiring rebuild of components, and that tracked vehicles have a 3 per cent probability of reaching 4000 miles without the failure of a major component. Here is [illegible]

until mobility has been developed and unless it can be sustained. in the civilian automotive industry.

The cost of military vehicles increases tremendously when special tooling is required for manufacture, since these heavy tooling costs must be amortized over short production runs. For this reason commercial components should be used [illegible] components considered components led applica- the proper xist. Not tween the per cent d the 30 ized must olish this ying to cable on possible d from ation of to its viron-

ing is e that s will cri- Army it an tand illed cial This ury air il- er

vehicles and their improved comfort and styling, higher speeds and easier handling, better operating economy and longer life, the civilian vehicle of today is at a distinct disadvantage in comparison with its counterpart of two or three decades ago when it is forced to operate off of modern highways. It should be obvious that, as the civilian vehicle becomes more and more dependent upon good roads, the difference between it and an off-road vehicle will ships. To rate high in strategic mobility, the ground vehicle should

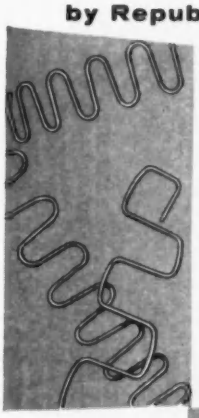
[illegible] to "failsafe" to avoid the loss of engines from short but destructive exposure to abrasive dusts.

It is the Army's responsibility to interpret the field usage environment to industry and to inform industry of the necessary maintenance criteria. Industry must, of course, recognize that in this area the Army is the expert. When this relationship has been established and definite tests outlined for the benefit of industry, it is likely that there will be a renaissance in such be compact in dimensions, light in weight, and designed to facilitate

REPUBLIC STEEL
IN AUGUST AND SEPTEMBER
WILL TELL THE 10,475,000
SUBSCRIBERS OF
THE SATURDAY EVENING POST,
TIME, NEWSWEEK,
U.S. NEWS & WORLD REPORT
ABOUT THE LASTING BEAUTY
OF STAINLESS STEEL TRIM
WITH THE
PAGE-AND-A-COLUMN AD
REPRODUCED ON THIS SPREAD

OTHER AUTOMOTIVE PRODUCTS SUPPLIED

by Republic Steel

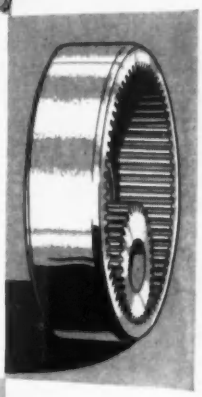


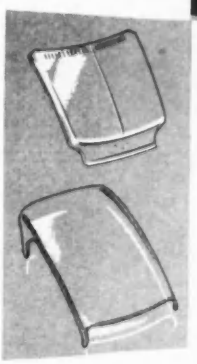
SPRING WIRE

Under all the padding, the ultimate cushioning against road bumps comes from steel — steel wire made into springs. Each model car requires differently designed seats: there are more than a hundred. The lowering of bodies creates a problem, too. Seat springs are allotted less height. One designer ingeniously engineered a flat spring of wire. Republic Steel furnishes many thousands of miles of this especially tough wire every year to spring makers.

ALLOY STEEL FORGING BARS

The whole plunging weight of your three thousand pound car crushes against one tooth of a gear. Gears forged from tough, strong alloy steels achieve a great safety factor through enormous strength. Republic Steel furnishes the superb alloy steels for the forgers of these gears as well as for such vital parts as steering mechanisms, spindles, bearings, and springs.





COLD ROLLED SHEETS

Republic is one of the few steel companies that can roll steel sheets wide enough for the hoods and tops of today's wide autos. These steel sheets are superior in surface, also, to provide a base for the superbly smooth finishes.

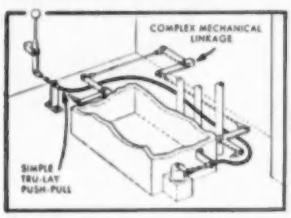
REPUBLIC STEEL

Besides being one of the biggest suppliers to the auto industry . . . the world's largest maker of aircraft quality steels, too.

THE TREND IN DRAFTING ROOMS THROUGHOUT THE WORLD IS TOWARD IMPERIAL, THE WORLD'S FINEST TRACING CLOTH

Circle 188 on Inquiry Card for more data

TRU-LAY PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY AND IMPROVE DESIGN



Push-Pull remote controls, shown here, are flexible, have but one moving part, and give a lifetime of accuracy. Mechanical linkages are complex, are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.

This Push-Pull Data File—containing 7 engineering bulletins—will show you how these flexible controls have eliminated mechanical linkages on hundreds of products. You can make *your* products more useful, easier to sell, with Push-Pull controls. Write for your Data File today.

Automotive and Aircraft Division
AMERICAN CHAIN & CABLE

ACCO

601-H Stephenson Bldg., Detroit 2
6800-H East Acco Street, Los Angeles 22
925-H Connecticut Ave., Bridgeport 2, Conn.

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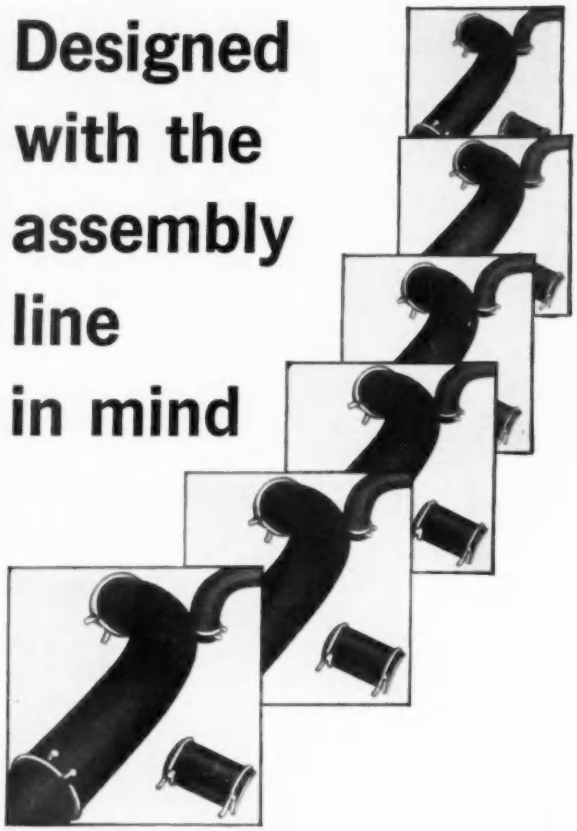
Designed with the assembly line in mind



CORBIN self-tightening hose clamps

INSTALLED IN SECONDS. Corbin hose clamps are made of tough spring steel which maintains a powerful circle of pressure around hose fitting. Once on they're tight — stay that way for the life of the hose, hot or cold. No wonder Corbin self-tightening hose clamps are "taking over" in plants where mass production techniques are employed.

Corbin hose clamps are backed by 15 years of field use and improvement. Specify self-tightening hose clamps by Corbin — there's a size for every hose fitting on your line. Fact folder HC18 gives full details and specifications.

CORBIN

CORBIN HOSE CLAMP DIVISION
THE AMERICAN HARDWARE CORP., NEW BRITAIN, CONN.

Circle 186 on Inquiry Card for more data

YOURS FOR THE ASKING . . .

the ALL-NEW AUTOMOTIVE INDUSTRIES

EDITORIAL INDEX (Vol. 120)

covering the issues from January 1 to June 15, 1959, inclusive

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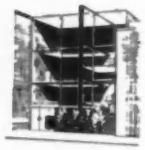
A CHILTON  PUBLICATION

INDEX TO ADVERTISERS

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A

AC Spark Plug Electronics Div. ... 128
AMP, Inc. ... 9
Air Reduction Sales Co. ... 34
Alan Wood Steel Co. ... 21
Allegheny Ludlum Steel Corp. ... 114
American Chain & Cable Co., Inc. Automotive & Aircraft Div. ... 132
American Sealants Co. ... 112
Amplex Div. (Chrysler Corp.) ... 44
Anaconda Aluminum Co. ... 29
Armstrong Cork Co. ... 27
Automotive Industries ... 133, 136

B

Babcock & Wilcox Co. Tubular Products Div. ... 2
Bendix Aviation Corp. Eclipse Machine Div. ... 89
Products Div. ... 5
Bendix-Westinghouse Automotive Air Brake Co. ... 16-17
Bethlehem Steel Co. ... 1
Bower Roller Bearing Div. ... 42
Bundy Tubing Co. ... 18-19
Burton Auto Spring Corp. ... 50

C

Caterpillar Tractor Co. ... 122
Chicago Pneumatic Tool Co. ... 90-91
Chicago Rawhide Mfg. Co. ... 20
Chrysler Corp. (Amplex Div.) ... 44
Copperweld Steel Co. Superior Steel Div. ... 33
Corbin Hose Clamp Div. ... 132
Crucible Steel Co. of America ... 43

D

Dana Corp. (Spicer) ... 120
Dayton Industrial Products Co. ... 124-125
Dole Valve Co. ... 87
Dow Corning Corp. ... 24
Dykem Co. ... 116

E

Electric Auto-Lite Co. ... 106-107
Engineering Castings Inc. ... 96
Enjay Co., Inc. ... 54

F

Fairfield Mfg. Co. ... 102
Federal-Mogul-Bower Bearings, Inc. Bearings Co. of Amer. Div. ... 98
Bower Roller Bearing Div. ... 42
Federal-Mogul Div. ... 12
National Seal Div. ... 26
Fitzgerald Mfg. Co. ... 135

G

Garlock Packing Co. Plastics Div. ... 110
Gisholt Machine Co. ... 105
Goshen Rubber Co., Inc. ... 104
Great Lakes Steel Corp. ... 14-15
Greenlee Bros. & Co. ... 117
Gridley Machine Div., New Britain Machine Co. ... 35-36

H

Heald Machine Co. ... 2nd Cover
Holley Carburetor Co. ... 109

J

Johnson Products, Inc. ... 108
Jones & Laughlin Steel Corp. Stainless Strip Div. ... 111

K

Keuffel & Esser Co. ... 132

L

Lamb Electric Co. ... 100
La Salle Steel Co. ... 23
Link Belt Co. ... 101
Lipe Rollway Corp. ... 11
Lord Mfg. Co. ... 97

M

McLouth Steel Corp. 95, 113
Mallory & Co., Inc., P. R. 81
Metal & Thermit Corp. 119
Midland-Ross Corp. 41
Milford Rivet & Machine Co. 112

N

National Lock Co. 118
National Screw & Mfg. Co. 85
National Seal Div. 26
New Britain Machine Co.
New Britain-Gridley Machine Div. 35-36
New Departure Div. ..... Back Cover

O

Olin Mathieson Metals Div. 103
Osborn Mfg. Co. 94

P

Pennsalt Chemicals Corp. 93

R

Ramco Div.
Thompson Products 123
Republic Steel Corp. 130-131
Rockford Clutch Div. 92
Rockwell Standard Corp.
Transmission & Axle Div. 32

S

Schrader's Son A. 126-127
Sealed Power Corp. 52
Sharon Steel Corp. 121
Southern Screw Co. 13
Sun Oil Co. 99
Superior Steel Div. (Copperweld Steel Co.) 33

T

Taylor Fibre Co. 8
Thompson Ramo-Wooldridge
Ramco Div. 123
Thompson Products Mich. Div. 22
Timken Roller Bearing Co. 115
Tinnerman Products, Inc. 129
Torrington Company 83
Tung-Sol Electric, Inc. 6

U

U. S. Axle Co., Inc. 25
Universal Cyclops Steel Corp. 30-31

V

Victor Mfg. & Gasket Co. 7

W

Wagner Electric Corp. 28
Western Felt Works 10
Wheland Co. 135

Y

Yoder Company 116

Z

Zollner Corp. ..... 3rd Cover

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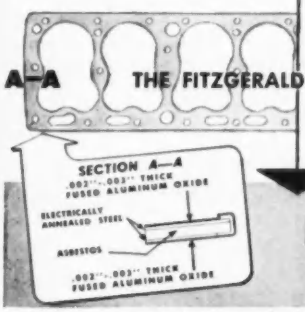

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FREE LITERATURE

Cutting Machine 1

The Oxweld CM-60, a shape-cutting machine that can automatically reproduce metal parts from exact size drawings, is described in detail in eight page booklet F-1294. *Linde Co., Div. of Union Carbide Corp.*

Automatic Presses 2

Minster presses, designed for the automatic production of metal stampings, are described and illustrated in a 12 page, two-color brochure issued by *The Minster Machine Co.* The advantages of automatic production in the metal stamping industry are discussed.

Casting Alloys 3

A compact guide to the major nickel-containing casting alloys has been published by the *International Nickel Co., Inc.* The booklet presents condensed data on the range of properties offered, industries served, and general application for each alloy included.

Plastic Parts 4

The physical properties and applications for Pyrotex, an asbestos-reinforced, thermosetting phenolic resin plastic, are listed in 12 page Bulletin 200. *Raybestos-Manhattan, Inc.*

A. I. Index 5

Check 5 on postcard for index to Vol. 120 (Jan. 1 to June 15, 1959) of AUTOMOTIVE INDUSTRIES.

Shaped Tubing 6

Shaped tubing in square, rectangular, eliptical, oval, and a variety of other cross-sections is illustrated and described in four page Data Memorandum No. 17 prepared by the *Superior Tube Co.*

Conveyor Catalog 7

Catalog CD-B, 16 pages, describes two types of conveyors made by the *Conveyor Div. of the American Mono-Rail Co.* Case histories show how the two units can be best utilized.

Clutches 8

Bulletin 134-C is a four page summary on Twin Disc multiple-plate clutches for machine tool applications. *Twin Disc Clutch Co.*

(Please turn page)

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

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FREE LITERATURE—*Continued*

Rotary Pump 9

The Waterous rotary pump, weighing 70 lb and having a capacity of 300 gpm, for application on over-the-road transports is featured in Form No. C-325. *Waterous Co.*

Melting Process 10

The Hopkins Process, a modern technique for producing high purity metals, is explained in an eight page brochure. Included in the brochure are tables showing physical properties at room and at elevated temperatures, illustrating the uniformity of Stercon H A-286, Discaloy, SAE 4340, and 16-25-6. *Firth Sterling, Inc.*

Adjustable Drives 11

GEA-6806, 16 pages, describes ¼ to 25 hp Polydyne mechanical adjustable speed drives. Principles of operation, configurations, and features, including mounting positions, rating tables, and descriptions of available accessories are listed. *General Electric Co.*

Conversion Table 12

Table TDC 110, a handy conversion table for changing inches and fractions of inches into decimal parts of a foot, has been issued by the *Tubular Products Div. of The Babcock & Wilcox Co.*

Welding Equipment 13

Catalog No. 12 illustrates and describes the complete line of arc welding cable connections and accessories available from *Tweco Products, Inc.*

Band Saw 14

An eight page bulletin from *Delta Power Tool Div., Rockwell Mfg. Co.* describes the Delta 20 in. metal-wood cutting band saw which features a variable speed drive from 50 to 4500 fpm for cutting materials from stainless steel to aluminum, wood and plastics.

Polyglycols 15

The third edition of "Choosing the Right Polyglycol," published by *The Dow Chemical Co.*, describes these relative newcomers to the chemical field. They are said to possess unusual combinations of physical and chemical properties which make them valuable both as intermediates and for the properties they contribute to an end product.

Cold Finished Steel 16

Physical properties of Jalcase 100, a free machining, stress stabilized cold finished steel bar, are explained in an eight page booklet. Jalcase 100 was developed for use in producing high quality machined parts. *Jones & Laughlin Steel Corp.*

Turret Drill 17

Turret Drilling Machine Catalog 1T contains features of design and construction of new turret drilling machines and work-positioning tables. *Brown & Sharpe Mfg. Co.*

Jog Borers 18

Pratt & Whitney end measure jig borers, designed and constructed for precision and ease of operation, are featured in 27 page Circular 614. These units have many advantages, including a precision preloaded ball roll quill, two independent measuring systems, and precision hand-scraped ways and guides. *Pratt & Whitney Co., Inc.*

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300

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FREE LITERATURE— *continued*

Spiral Point Drill 19

Catalog SP-165 entitled "The Spiral Point—A New Era In Drilling," describes spiral point geometry for converting standard twist drills into precision tools, illustrates advantages to be obtained, and shows operation of the Cincinnati Spiropoint drill sharpening machine which permits quick and easy set-up. *Cincinnati Lathe and Tool Co.*

Descaling Machines 20

Bulletin 609 describes the complete line of Rotoblast descaling machines. Photos, diagrams, cut-aways and sketches show details and operating features of the Rotoblast wheels which provide the cleaning force of the mechanical descaling equipment. *Pangborn Corp.*

Industrial Gases 21

Industrial gases for a variety of applications are described in a booklet prepared by *Air Reduction Co., Inc.* The booklet tells the method of producing, various uses, and method of delivery for oxygen, nitrogen, argon, helium, acetylene, hydrogen, neon, krypton, xenon, and carbon dioxide.

Metal Spinning 22

Metal spinning techniques are described and illustrated in Data Book No. 3. Included in the book are such items as the mechanics of metal spinning, basic shapes, range of metals suitable for spinning, and interesting applications. *Spincraft, Inc.*

Indexing Units 23

Standard Tool & Mfg. Co. has prepared a bulletin on their cam operated indexing units, Models ST-A9B, ST-A9C, and ST-A9D. In addition to drawings, the booklet lists tables of indexing positions and cams, results of accuracy tests, and dimensions of standard tooling and dial plates.

(Please turn page)

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41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	**60**
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	**80**
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	**100**
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	**120**
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	**140**
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	**160**
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	**180**
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	**200**
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	**220**
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	**240**
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	**260**
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	**280**
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	**300**

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Pump Bulletin 24

Short-coupled, vertical turbine-type pumps for a wide range of applications are described in Bulletin 08B9409. The pumps are available in 40 sizes, 20 to 8000 gpm at heads of 400 ft or more. *Allis-Chalmers Mfg. Co.*

Carbide End Mills 25

Catalog 559, 12 pages, covering a line of solid carbide end mills is available from *Kennametal Inc.* It covers a line of precision ground, fluted end mills in fifteen different styles from solid bars of Kennametal tungsten carbide.

Tracer Turning Tools 26

Bulletin 459, four pages, describes a standardized line of Multicut tracer turning tools that use standard 55 degree diamond-shaped throw-away carbide inserts. Complete dimensions and tolerances are included. *Wesson Co.*

Threading Lathe 27

The Gisholt Machine Co. has published Bulletin 1215 which features the Gisholt Cri-Dan Model "B" high-speed, semi-automatic, single point, threading lathe.

Material Handling 28

The *Louden Machinery Co.* has prepared a comprehensive 52 page catalog on the subject of overhead material handling. The selection of, and the different types of equipment available for the most efficient handling systems are discussed.

Vibrator 29

Four page Bulletin 1930E describes the 15 hp Lorco Vibrator. Detailed specifications are given, as well as construction features, standard equipment and general information. *Lord Chemical Corp.*

Dry Dust Collector 30

Bulletin 291A describes the characteristics and operation of the AMERclone dry centrifugal dust collector. *American Air Filter Co., Inc.*

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No Compromise with Strength in Design

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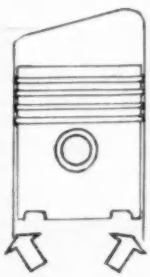

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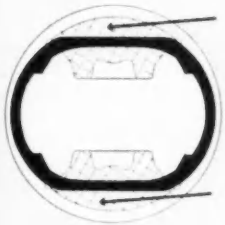
Automatically maintains uniform effective skirt clearance at all temperatures.



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20% greater section for heat conductivity.

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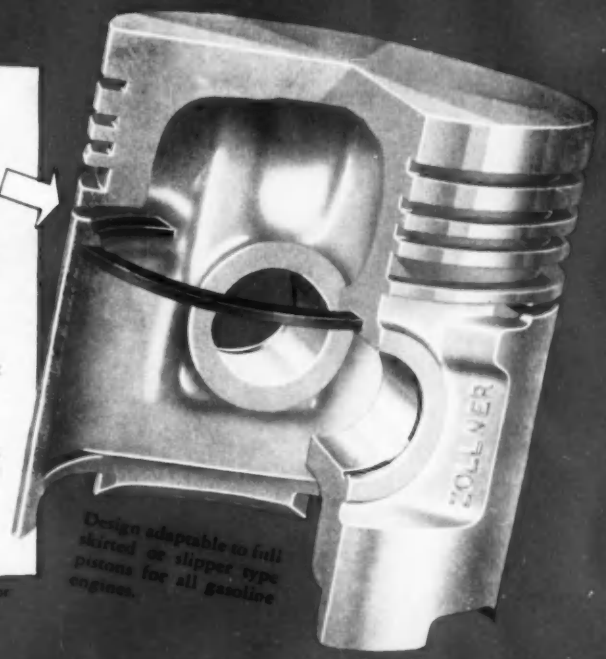

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Extensive testing revealed sluggish response of automobile speed control device.

SOLUTION:

N/D Sales Engineer, in cooperation with manufacturer, recommended replacing existing pure thrust bearing and bushings with New Departure double-shielded ball bearings. These light-duty, non-loading groove bearings, with uninterrupted ball raceways, withstand radial and thrust loads in any combination. This change resulted in virtually friction-free operation of the speed control device, correcting the response problem. What's more, these New Departures eliminated a lubrication problem and simplified assembly and maintenance.

Perhaps there's a New Departure automotive production ball bearing that will help solve a problem in your product . . . or produce an over-all cost savings. For more information, write Department C-8.

Replacement ball bearings available through United Motors System and its Independent Bearing Distributors

NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

Circle 103 on Inquiry Card for more data